THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXXVI. No. 919.] LONDON, DECEMBER 21, 1880. [32ND YEAR. Price 6d.

GAS PURIFICATION
BY
OXIDE OF IRON.

COOKE BROS.,
CENTRAL DEPÔTS:
CO. DONEGAL, IRELAND;
LONDON DEPÔT:
ERITH,
OFFICES:
2, CROSBY SQUARE,
LONDON, E.C.

GENUINE TORBAY PAINT
And SPECIAL GASOMETER PAINT.
SEVERAL PRIZE MEDALS. ESTABLISHED OVER 20 YEARS.
These Paints are now used by all the London Gas Companies and most of the principal Country Gas Companies, on Gas-holders, Scrubbers, Purifiers, &c. Also used by the Admiralty, War Office, Railway Companies, Founders, &c. They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations; do not crack, blister, or flake off; will cover tar effectually.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov.* 2, 1866.
Supplied, mixed ready for use, or in paste, as desired.
TORBAY PAINT COMPANY.
PROPRIETORS: STEVENS & CO.,
21, GREAT WINCHESTER STREET, LONDON.
WORKS: BRIXHAM, TORBAY.

TUBES.
FIRST PRIZE SYDNEY EXHIBITION 1880
Tubes and Fittings for Gas, Steam, Water, and Hydraulic purposes, plain, galvanized, white enamelled inside, or coated by Dr. Angus Smith's process, or oxidized by Prof. Barff's patent process. Gas-fitters tools, brass cocks, &c.
JOHN SPENCER,
VULCAN TUBE WORKS,
WEST BROMWICH, STAFFORDSHIRE,
& 97, CANNON ST., LONDON.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and other OBJECTS in FIRE-CLAY," and they were also awarded at the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
JOS. COWEN & CO. are the only Manufacturers of FIRE-BRICKS and CLAY RETORTS at BLAYDON BURN.

JOHN RUSSELL & CO.,
LIMITED,
Established at the commencement of Gas Lighting,
MANUFACTURERS OF
TUBES AND FITTINGS.
THREE PRIZE MEDALS,
Paris, 1878.
HEAD LONDON OFFICE:
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ALMA TUBE-WORKS, WALSALL;
OLD PATENT TUBE-WORKS, WEDNESBURY.

JOHN BENT & SON,
BELL BARN ROAD, BIRMINGHAM,
MANUFACTURERS OF
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LICENSEES AND MANUFACTURERS OF
HUNTS
PATENT COMPENSATING METERS,
STREET-LAMPS, &c., &c.
ESTABLISHED 1830.

THOMAS PIGGOTT & CO.,
SPRING HILL, BIRMINGHAM,
MANUFACTURERS OF
TELESCOPIC & SINGLE GASHOLDERS,
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
SUGAR, SALTPETRE, AND ALL KINDS OF PANS.
Roofs, Girders, and Bridges, and General Smith's Work.
London Offices: 97, CANNON STREET—
JAMES E. & SAMUEL SPENCER, Agents.

THE
"OTTO" GAS-ENGINE,
From ½ to 40 H.P. ind.
See Page 958

CROSSLEY BROTHERS,
MANCHESTER AND LONDON.

THE
DUKE OF HAMILTON'S
LESMAHAGOW
CANNEL COAL,
AGENT:
JAMES M'KELVIE,
HAYMARKET,
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ESTABLISHED 1840.

GEORGE GLOVER AND CO.,
PATENTEES OF THE
NATIONAL STANDARD GASOMETERS
AND MANUFACTURERS OF
IMPROVED DRY GAS-METERS.
GOLD MEDAL. HIGHEST AWARD.

INTERNATIONAL EXHIBITION,
SYDNEY, 1880.
RANELAGH WORKS, ROYAL AVENUE, CHELSEA, LONDON, S.W.
1, LANCASTER AVENUE, MANCHESTER.
Foreign Agents: DAHL BROS., Copenhagen; A. FAAS & CO., Frankfort-on-Maine; W. HOVEN & SON, Rotterdam; COPLAND & M LAREN, Montreal; A. DEMPSTER, 57, Elizabeth Street, Melbourne.

WELLINGTON TUBE WORKS,

GREAT BRIDGE, TIPTON, STAFFORDSHIRE.

JOSEPH AIRD,

GAS, STEAM, AND HYDRAULIC TUBES AND FITTINGS.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER AND BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM (Established 1765),

MANUFACTURER OF

TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST-IRON TANKS FOR DITTO.

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, AND ALL KINDS OF GAS APPARATUS.

WROUGHT-IRON ROOFS, BRIDGES, GIRDERS, ETC.

STEAM, HOT WATER, AND RANGE BOILERS, TANKS, CISTERNS, BOATS,

AND ALL KINDS OF WROUGHT-IRON WORK.

Drawings, Specifications, and Estimates supplied on application.

GOLDSMITH'S PATENT SIGHT WATER-LINE INDICATING GAS-METER.

MANUFACTURED BY GUEST AND CHRIMES,

FOUNDRY AND GENERAL BRASS WORKS, ROTHERHAM; AND 5, SOUTHWARK ST., LONDON, S.E.

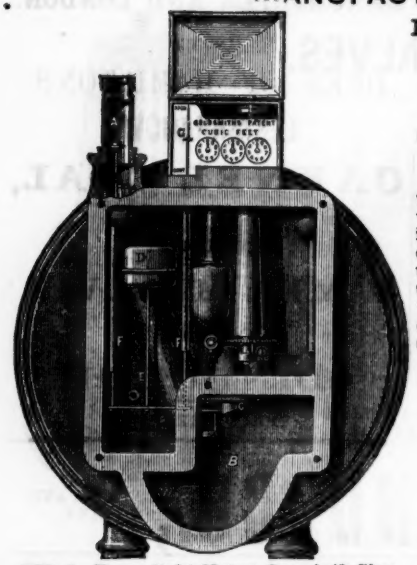

FIG. 1.—Three-light Meter, One-sixth Size.

Fig. 1 is a Meter with front removed to show the arrangement and connection of the Indicator and Valve.

Fig. 2 is front view of Index, with cover up.

The principal object of this invention is to render the water-line in the reservoir at all times visible. It will be seen, by reference to the illustrations, that this is accomplished in the following manner:—On the dial are the words "Open" and "Shut," and attached to the float is the pointer G, which rises and falls with the water-line in the reservoir. If the pointer is at "Open," it shows that the valve is open, and that the reservoir is full. If it is at "Shut," it shows that the reservoir is empty, and that the gas will be shut off.

The following ADVANTAGES will be obvious:—

1. The Inspector can see at a glance if the Meter requires water.
2. No more water than is required need be added, and therefore no water has to run out.
3. The Meter Inspector will be spared a great deal of his most objectionable work, and he will save a great deal of time and trouble.
4. The consumer will not always have to be asked for water, nor will he have to endure the unpleasant smell caused by waste water being run out.

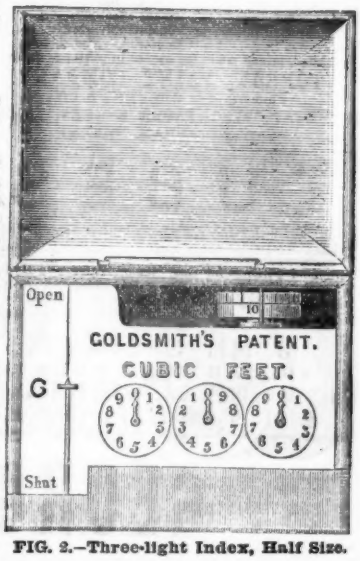

FIG. 2.—Three-light Index, Half Size.

TRADE MARK.

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

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WEDNESBURY, STAFFORDSHIRE.

WAREHOUSE: SOUTHWARK STREET, LONDON.

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PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;

LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;

HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.,

GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM.

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

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GAS *v.* ELECTRIC LIGHT.

WIGHAM'S PATENT LIGHTHOUSE GAS-BURNERS,

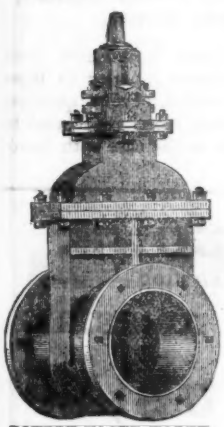
For Street Lighting and the Illumination of Large Halls, Factories, Ship Yards, &c., where Powerful Light is required

These Burners have been adopted by a School Board, having large school-rooms in charge, because of their high illuminating power and the facilities they give for perfect ventilation. The actinic power of these Burners is such that they are used successfully for Photography and Photo-Lithography.

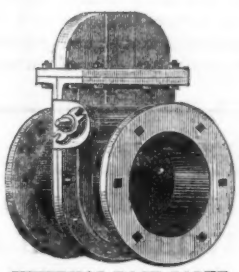
SOLE MANUFACTURERS:

J. EDMUNDSON & CO., Gas Engineers, 19, GREAT GEORGE STREET, WESTMINSTER, LONDON, S.W.

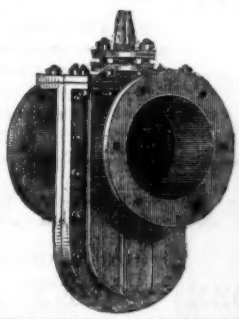
C. & W. WALKER'S GAS-VALVES.



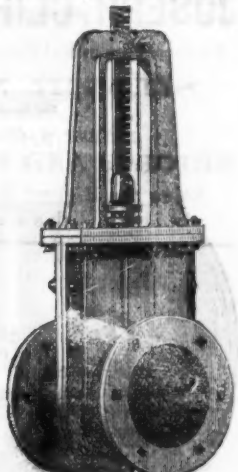
DOUBLE-FACED VALVE SPECIALLY FOR PURIFIERS.



INTERNAL RACK-VALVE WITH STEEL PINION, FOR GENERAL USE.



UNDERGROUND SCREW-VALVE FOR SHALLOW STREET-MAINS.



ORDINARY RACK AND PINION VALVE.

MIDLAND IRON-WORKS,

DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

LIVESEY'S PATENT WASHER.

This apparatus effects the most intimate contact between the liquor with which it is supplied and the gas passing through it, resulting in the complete removal of all particles of tar, increasing the ammonia strength of the scrubber and condenser liquor, and removing a large proportion of other impurities—notably, carbonic acid. The Washer is intended to work in conjunction with a scrubber. It occupies little space, and is inexpensive. It does not become clogged with tar or corroded by the action of the liquor or gases, it gives three inches of pressure, and only needs a supply of liquor to keep it in regular action without any further attention. It has been in constant successful use for five years, and is now in operation in upwards of fifty places.

Prices, fitted and fixed complete, exclusive of Valves and Connections; all foundations and unskilled labour required in erection to be provided by the Gas Company:—

Quantities to pass in cubic feet per 24 hours	100,000	250,000	500,000	750,000	1 million	1½ million	2 million	3 million	4 million
Price each	£30	£50	£70	£95	£120	£165	£200	£280	£360

For further Particulars apply to

Messrs. DEMPSTER AND SONS, ELLAND, HALIFAX, for the North;

Messrs. BAILEY, PEGG, AND CO., Bankside, LONDON, S.E., for the South;

Messrs. WILLEY AND CO., Commercial Road, EXETER, for West of England and South Wales;

Or to the PATENTEE, 589, OLD KENT ROAD, LONDON, S.E.

GAS PURIFICATION
BY
OXIDE OF IRON.
GAS PURIFICATION & CHEMICAL Co., LIMITED,
PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.

JOHN WM. O'NEILL, Managing Director.

WARNER'S RETORT-HOUSE MACHINERY.
[*As Illustrated and Described in the* JOURNAL *for May* 4.]

Communications to be addressed to
W. J. WARNER, GAS-WORKS, SOUTH SHIELDS.

PARIS EXHIBITION, 1878.

THREE MEDALS
AND
HONOURABLE MENTION
HAVE BEEN AWARDED TO
JOSEPH CLIFF & SONS
For their Various Exhibits, amongst which is a
SILVER MEDAL
FOR THEIR
PATENT MACHINE-MADE
RETORTS AND FIRE-BRICKS,
Being the Highest Honour given for this class.

Established

1795.

JOSEPH CLIFF & SONS,
THE ORIGINAL
WORTLEY FIRE-BRICK WORKS,
NEAR **LEEDS,**
London Wharf: No. 4, inside Great Northern Goods Station, King's Cross, N. Liverpool: Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to the compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

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GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,
ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE.
MANUFACTURERS OF EVERY DESCRIPTION OF
GAS APPARATUS;
CONTRACTORS FOR THE
ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.

SAMUEL CHANDLER & SONS,
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GAS ENGINEERS, PATENTEES, AND CONTRACTORS.
(OF KIRKHAM, HULETT, AND CHANDLER, LIMITED.)

They undertake the SUPPLY and ERECTION of ENGINES and GEARING for actuating the PATENT "STANDARD" WASHER-SCRUBBER, or furnish DESIGNS and ESTIMATES for any kind of GAS APPARATUS, Alterations or Extensions, &c.

ADDRESS:
CENTRAL WORKS, 104, NEWINGTON CAUSEWAY.

KIRKHAM, HULETT, & CHANDLER, LIMITED.

PATENT "STANDARD" WASHER-SCRUBBER,

FOR

GAS PURIFICATION,

TAKES OUT EVERY TRACE OF AMMONIA AND A LARGE QUANTITY OF CARBONIC ACID AND SULPHURETTED HYDROGEN BY ONCE PASSING THROUGH THE MACHINE.

AMMONIACAL LIQUOR OBTAINED OF ANY REQUIRED STRENGTH.

The Cost of the Machine defrayed by the Ammonia obtained in Twelve Months. It requires very little attention, and cannot get out of order.

These Machines, which contain from 3200 feet to 65,000 feet of Wetted Surface, are supplied to the following Gas-Works:—

The Gaslight Company—	Feet per Day.		Feet per Day.		Feet per Day
Beckton	7,500,000	Leeds Corporation	14,000,000	West Bromwich Improvement Commissioners	1,000,000
Bromley	7,000,000	Leominster Company	150, 000	Radcliffe and Pilkington Co.	750,000
St. Pancras	3,000,000	Maidstone Company	1,000·000	Falmouth Company	150,000
Shoreditch	2,500,000	S. Metropolitan Co., Greenwich	2,500,000	European Company, Rouen	250,000
Bradford Corporation	1 000,000	Ditto, Vauxhall	3,000,000	Deal Company	200,000
Bremen Company, Germany	150,000	Woolwich Equitable Company	400,000	Leyden Company, Holland	560,000
Dukinfield Local Board	500,000	Yeadon Company	500,000	Kingston-upon-Hull Company	400,000
Driffield Company	100,000	Salford Corporation	5,250,000	Ilkeston Local Board	250,000
Goole Company	250,000	London Gas Co., Nine Elms	3,000,000	Dover Company	750,000
Glossop Company	300,000	Nottingham Corporation	1,250,000	Frankfort Company	300,000
Holywood Company, Ireland	125,000	Cheltenham Company	2,000,000	Huy, Belgium	70,000
Heywood Local Board	600,000	Buxton Local Board	250,000		

Washers in course of Construction—

	Feet per Day.		Feet per Day.		Feet per Day
Yeovil Company	250,000	Oldbury Local Board	500,000	Newport, U.S.A.	250,000
S. Metropolitan Co., Vauxhall	3,000,000	Altrincham Company	600,000	Ramsgate Local Board	1,000,000
Derby Company	1,500,000	Cannes, France	200,000	Sydney Company	1,000,000
Harrow Company	250,000	Kidderminster Company	750.000	Bradford Corporation	3,750,000

TESTIMONIALS.

Messrs. Kirkham and Hersey. *The Gaslight and Coke Company, Beckton, North Woolwich, June 8, 1880.*

Gentlemen,—I enclose you some particulars of the working of your Washers here, and I intend having some more experiments made, as just now we are working the first Washer with liquor, and the second with water. Of course the fact of our having ordered two more in addition to the four which we have in use is a sufficient indication of my opinion of the value of the Washer. (Signed) G. C. TREWBY.

Messrs. Kirkham and Hersey. *25, Palace Chambers, Bridge Street, Westminster, S.W., July 19, 1880.*

Dear Sirs,—The "Standard" Washer which you supplied for use at the Vauxhall station of the Phœnix Gaslight Company afforded me entire satisfaction. It was designed to remove the ammonia from 3 million cubic feet of gas per day, and during the past winter it did so with a good working margin to spare. It is as excellent now in workmanship as in design, and is well worthy the general acceptance with which it appears to be meeting.

I am, faithfully yours, (Signed) CORBET WOODALL.

Messrs. Kirkham and Hersey. *Phœnix Gaslight and Coke Company, Office, Greenwich, S.E., Aug. 12, 1879.*

Gentlemen,—In reply to your inquiry, one of your Patent Scrubber-Washers to purify 100,000 cubic feet per hour was put into operation at these works on the 1st of June. At the same moment the whole of our Scrubbers, equal to 28,000 cubic feet, were thrown out of use, leaving your Washer the whole work of freeing the gas from Ammonia. This it has done to perfection up to date. With 10 gallons of water to each ton of coal carbonized passing through it we get a clean test at the seventh chamber, leaving four chambers margin for extra work. The mean quantity of Ammonia in the inlet (fixed and free), obtained from a large number of tests, was 241 grains per 100 feet of gas. On the outlet—Free Ammonia—Nil. The quantity of water used is 10 gallons per ton of coal carbonized. The strength of liquor as follows:—

Chamber No.	1	2	3	4	5	6	7	8	9	10	11
Strength of liquor—ounces	Nil.	Nil.	Nil.	Nil.	0·4	1·0	2·2	3·5	5·5	8·25	12·5

We are working five revolutions per minute. It takes out all the free Ammonia, reduces the carbonic acid and sulphuretted hydrogen 30 per cent., requires a very small amount of power to drive, and altogether is, in my opinion, the best machine for the purpose yet invented, and will, I feel confident, ere long, entirely supersede the Scrubbers of to-day. I am glad to find you are going to fix one of these Washers at our Vauxhall works.

(Signed) P. J. WATES, Engineer.

For other Testimonials, see next week's Journal.

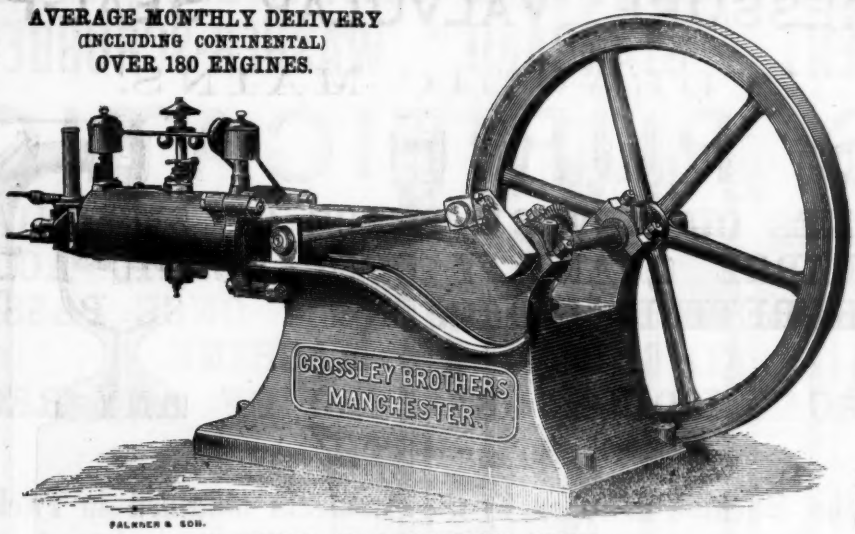
FOR FURTHER PARTICULARS AND TESTIMONIALS, ADDRESS MESSRS.

KIRKHAM, HULETT, & CHANDLER, LIMITED, { 59 & 60, Palace Chambers, Bridge St. Westminster, London, S.W.

AN ENGINE WHICH WORKS WITHOUT A BOILER OR STEAM

These Engines are used at the following Gas-Works:—Birmingham, Brentford, Bucharest, Bishop Stortford, Driffield, Dundalk, Dundee, Dublin, Huddersfield, Hinckle London—Lond n Gas-Works, Phœnix Gas Co., Gaslight and Coke Co., South Metropolitan Gas Co., Commercial Gas Co., Crystal Palace District, Leominster, Edinburgh and Leith, Ludlow Union, Lancaster, Maidstone, Nuneaton, Northampton,

AVERAGE MONTHLY DELIVERY
(INCLUDING CONTINENTAL)
OVER 180 ENGINES.



FALKNER & SON.

Shanghai, Sheffield, Worcester, Wantage, &c.

Over 2500 already delivered.

Very numerous Testimonials from Users, including Engineers, Men of Science, and others, on application to the makers.

No trouble with Coal, Ashes, Smoke, Insurance, Water, or constant attendance.

No Glands to pack, or Water Gauges and Steam Gauges to watch.

STARTS AT A MOMENT'S NOTICE.

THE "OTTO" SILENT GAS-ENGINE,

From ½ to 40 Horse Power Indicated.

(Otto and Crossley's Patents, 1876 and 1877.)

THEY ARE USED FOR ALL KINDS OF PURPOSES, CHIEFLY FOR EXHAUSTERS, SCRUBBERS, & PUMPS.

DELIVERED IN MANCHESTER. CASES NOT CHARGED IF RETURNED FREE.

PRICES INCLUDE CAST-IRON STAND, TURNED FLY-WHEEL, AND DRIVING PULLEY; WATER-VESSEL, SEVERAL DUPLICATES, AND GAS-FITTINGS (EXCEPTING METER AND PIPES).

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(ESTABLISHED 1851,)

GAS ENGINEERS & CONTRACTORS

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TELESCOPIC AND SINGLE-LIFT GASHOLDERS,

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IMPROVED FIXED OR TRAVELLING HYDRAULIC PURIFIER-COVER LIFTERS,

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TAR AND LIQUOR PUMPS, HYDRAULIC SLUICE AND SLIDE VALVES, LAMP-POSTS AND HYDRANTS COMBINED.

DESIGNS AND ESTIMATES SUPPLIED ON APPLICATION.

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ABERCORN FOUNDRY & ABBEY WORKS, PAISLEY, N.B.

MECHANICAL CONDENSATION.

The undersigned has arranged with Messrs. Pelouze and Audouin the exclusive agency for their patented system of Condensation, in Great Britain and the Colonies.

The following are some of the advantages which this philosophic mode of arresting liquefiable vapours possesses:—

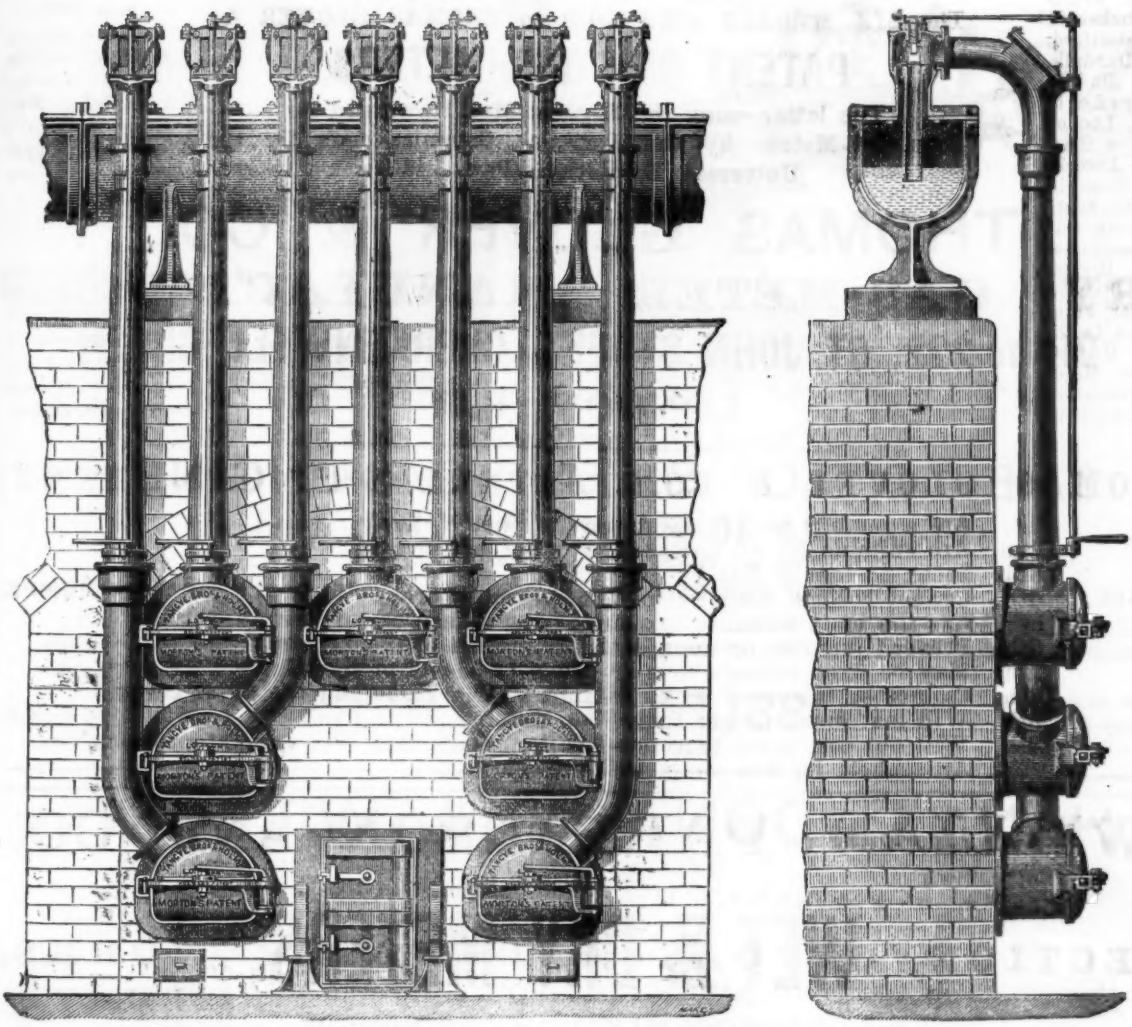
1. It acts irrespective of temperature.
2. It requires no motive power, but automatically adapts itself to production.
3. It may be fixed directly after the hydraulic main, by which prolonged contact of the gas with tar is avoided, and the highest standard of illuminating power is obtained which the coal is capable of giving; or it may be fixed directly after an ordinary air condenser, when it will arrest the vapoury globules which cooling alone will not stop, and the production of tar and ammonia water is thereby increased.
4. It effects a considerable saving in purification, through no tar getting to the material to clog its action.
5. It entirely supersedes the necessity of scrubbers; and if wet sawdust be used in a purifier, washers also are unnecessary.
6. It occupies but little space, and avoids that which is now considered a disadvantage—the too much cooling, scrubbing, and washing of gas.

Further particulars may be obtained of

GEO. BOWER, St. Neots, Hunts.

NOTE.—*Gas-works contracted for complete, or apparatus supplied in detail from the retort to the burner. "The Gas and Water Engineer's Book of Reference," post free, 5s. "Handy Abstract of the Public Health Act, 1875," post free, 1s.*

HOLMAN'S PATENT
NON-PRESSURE VALVULAR SEAL-PIPES
FOR
HYDRAULIC MAINS.



The salient features of the above arrangement are as follows:—

1. The Seal is instantaneously opened and closed from the stage by the stokers.
2. There are only two positions for the actuating lever: one when the Seal is opened during the period of carbonization, the other when it is closed for drawing and charging the retort.
3. The retort can never be blocked, beause the port directing the gas *through* the Seal is always opened, and the port permitting the gas to *pass* the Seal *direct* into the hydraulic main is also open while the retort is at work.
4. The manager and stokers can always see at a glance, by the position of the lever, whether the retort is duly unsealed while carbonizing its charge.
5. There are no extraneous seals, stuffing-boxes, hinges, screws, chains, pulleys, springs, teeth, or other complication belonging to the valves; they are made plain and strong for rough use, and will last many years without renewal.
6. The valve faces are always covered and never separated, hence no foreign matter can put them out of action.
7. They are positive, reliable, interchangeable, free from all the uncertainty of automatic arrangements, and low in price.
8. No extra pipes or connections are required, because the Valvular Seal-pipe is self-contained in the single branch of the ascension-pipe, which stands on the hydraulic main, and is easily accessible by removing an ordinary cover secured by two bolts only.

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They are to be fitted to the Hydraulic Mains of the New Retort-House at the LONDON GAS-WORKS, and at other large stations.

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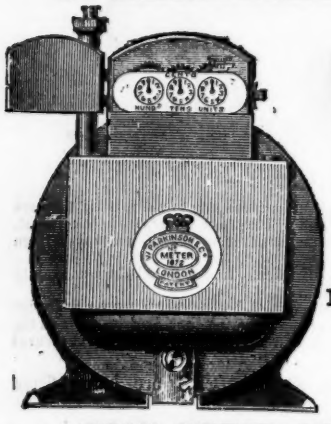

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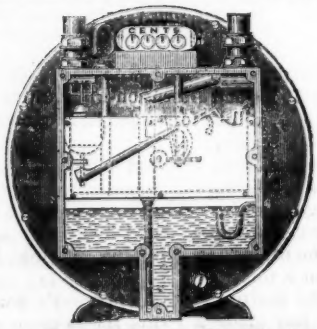

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SPECIAL NOTICE TO SUBSCRIBERS AND OTHERS.

In consequence of the CHRISTMAS HOLIDAYS, the next number of the JOURNAL will not be published until Wednesday, the 29th inst.

TO CORRESPONDENTS.

H. G.—*Too late for insertion this week.*

A Country Manager.—*Have you noticed our fortnightly reports of "Current Sales of Gas Products"—one of which appeared last week, page 936. As opportunity occurs we shall extend the reports so as to include sales in other of the large centres of the chemical industry.*

A Country Manager (No. 2).—*The works to which you refer can obtain gas from any source they choose. You cannot exclude your rivals supplying gas to the whole of the establishment—even to those parts lying within your parliamentary limits, if we understand aright the very vague particulars you give. It would be well for the future to remember the lines: "He who will not when he may; when he will, he shall have, nay."*

In *the "Circular to Gas Companies" last week, second column of page 922, a transposition of lines occurred. The 18th line should have been the 20th.*

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 21, 1880.

Circular to Gas Companies.

The winter draws on apace, Christmas will soon be with us once more, the days are even now at their shortest, and yet, in London at least, the weather has been exceptionally mild during the past few weeks, and, stranger than all, there has been little or no fog. Perhaps this accounts for the fact that fogs have formed very popular subjects of discussion of late. If there has been but slight fog in our streets, there has been plenty in the minds of a number of people. Fogs have been indicted at the bar of public opinion; they have been lectured about, written upon, and talked of until the discussion on the subject bids fair to become almost as great a nuisance as the fogs. Much of the public interest in the matter is undoubtedly due to Dr. Alfred Carpenter, who has made a regular hobby of the subject. It is perhaps difficult to see why Dr. Carpenter should particularly concern himself with London fogs, except probably that the whole subject is one which, from its nature, is certain to appeal strongly to public notice, and may be carefully worked up into an unlimited number of letters to the newspapers, and into not a few lectures, by any one who will take the trouble to treat it in a *pseudo*-scientific manner. We are nothing now-a-days if not scientific, and it is consequently possible for any persevering "scientist" to obtain a certain amount of *kudos* by dressing up a familiar subject in language calculated to convey the impression that he knows more about it than other people. We are afraid that Dr. Carpenter's case is something like this. When he first wrote to *The Times* the graphic letter, describing a West-end fog, which furnished that organ with material for a social leader, he did good service by calling attention to a decidedly preventible nuisance. Unfortunately, the notoriety he thereby obtained has apparently convinced him that he is the authority of the age on fog and its cure, and he has given the world his views thereon in several published letters, and at least two lectures. It is necessary to say that, as far as Dr. Carpenter is concerned, the subject has been already overwrought, and unless he has something better to offer by way of suggestion for the prevention of fogs than is contained in his lecture before the Society of Arts on the 8th inst., he had better dismount from his hobby before that long-suffering creature throws him. The matter is too important to be allowed to suffer from the feeble advocacy of persons whose sole right to deal with it is in their own pertinacity. Sanitation generally has almost become a bore from the number of *dilettanti* who have taken to meddle with it. Social Science is in the same plight. It would be a cause for regret if the rising discontent with the existing conditions of town life, which make yellow fogs possible, were to be similarly stifled by the multitude of would-be experts endeavouring to mount by it into publicity. Yet this will assuredly be the result, unless the present discussion takes a more hopeful turn.

Dr. Carpenter's last lecture is divisible into two parts—the description of the evil, and its possible cure. The first we all know about. A moment's experience of a pea-soup fog will convince one that coal-smoke is its chief constituent, more powerfully than columns of exhaustive disquisition as to what is not. It then only remains to remember that the chief source of coal smoke is the combustion of the usual fuel of domestic hearths, to arrive at the mental conclusion that if the smoke-producing action of such fires could be better regulated, or altogether abolished, fogs or mists might recur, but they would be divested of that quality which constitutes the great nuisance complained of in towns. This conclusion appears so direct that it is the merest waste of time to dilate upon it further. The pungent odour of the smoke of a moorland village is sufficient evidence of the peat fires of the cottagers, without an analysis of the air of the locality; and as little do we require a lecturer to tell us of what our town fogs are made. The second part of the lecture in question is, however, that to which we take the greatest exception, although it seems to have been the lecturer's object to advocate the extended use of gas. Briefly, Dr. Carpenter wishes to invoke Government aid for the purpose of carrying into force the following extraordinary proposals:—Local Authorities are to be empowered to levy a tax upon every fireplace so constructed as not to consume its own smoke. There is no question of how this is to be effected, the intention being by implication to render coal fires altogether illegal. The proceeds of this tax are to be used in the purchase of the gas and water works of the district, thus enabling the Local Authority to acquire these undertakings without having recourse to the rates for raising the necessary capital. "Gas, like water, has become a necessity of life; no "large town can carry on its work in the world without gas. "It is false political economy for dividends from gas and "water to be paid out of the life-blood of the country. Its "property should provide the capital for the purchase of such "works. That capital should be sunk at once, and the consumers of both gas and water should only be called upon to "pay the cost price of the product, with such other charges "as might be sufficient for the maintenance of the works in an "efficient state; and, when extensions are required, the property requiring the extension should pay the cost." We quote this sublime passage, as we feel quite unequal to the task of paraphrasing it so as to do justice to the glorious jumble of principles it contains. Read with the prior suggestion of the tax on smoke and its application, it clearly shows the lecturer's command of his subject. Immediately after this, the example of the Metropolitan area is given, as it would be affected by the new regulations. Supposing four million fireplaces to be now in existence within this district, we are

bidden to calculate in this wise:—"An average tax of 20s. "upon each of these, payable after two years notice, would "cause the removal of three-fourths of them, and the remain- "ing million would provide a fund which would, for a time, "go some way towards paying off principal and interest upon "the purchase of the London Companies claim in their "works." Besides this, no coal is to be sold for private use which has not been deprived of its smoke-producing qualities.

This is Dr. Carpenter's plan for rendering London smokeless and fogless. Criticism pales before such autocratic counsel; but we are constrained to remark that Dr. Carpenter has omitted to state one or two things needed to complete the scheme. He does not say when he expects to find a Government with so little other harassing employment that it will undertake a crusade against every house-coal proprietor, railway company, shipowner, coal merchant, and greengrocer in the land, to say nothing of other vested interests, and impose a tax certain to send every householder over to the Opposition. Neither does he say what would become of the Local Authority and their officials, if they were to attempt to collect such a tax. The window tax was enough for the Briton to bear, even at a time when he was more inured to taxation, indirect and otherwise, than he is at present; but a tax on light is a trifle to a tax on warmth. We should imagine that Dr. Carpenter himself would hardly care to be the first to collect it in a densely populated and smoky neighbourhood; in all probability there would soon be a vacant collectorship. It would also have been as well if Dr. Carpenter had told us precisely how far the million pounds to be obtained in such a way would go in purchasing the Metropolitan gas and water undertakings. And it might have been stated what should be done with the proceeds of the tax in such towns as Manchester, Leeds, and Birmingham, where there are no gas and water works to be purchased from private undertakers.

It may as well be stated at once that in respect of the practicality of his ideas—for they are nothing more—Dr. Carpenter must be classed with Dr. B. W. Richardson. In fact, if the former had headed his discourse with some distinctive title, to show that he intended to describe how the inhabitants of Salutland manage to escape fogs, he would have been more consistent than in recommending such visionary schemes for the land we live in. Dr. Carpenter has had his say on the matter of fog-prevention, and it is to be regretted that so much of what he has said is simply trash. Speaking in the interest of gas manufacturers, we distinctly repudiate all desire for assistance in extending gas consumption by compulsory legislation of any kind, or for parliamentary aid in any way, except in the removal of disabilities when they are proved to exist, and in the regular protection of gas property. The idea of revolutionary enactments such as some of the modern school of social and sanitary reformers so calmly contemplate, is too absurd even for ridicule. The extended consumption of gas for purposes other than lighting is a very desirable thing, but it will come without laws rendering it penal to have a coal fire. If Dr. Carpenter were to follow the example of Dr. Siemens, and give some practical help towards the final extinction of coal fires by suggesting a good substitute wherein gas is used, the public would have much more cause to be grateful to him than for his recommendation of legislation for which neither the time nor the subject is ripe. Dr. Carpenter prophesies that coal gas will cease to be used for lighting purposes. It may be that such a time will come, but in all probability not before it is made felony to sell coal. Meanwhile, we are not in such a bad case that we can afford to congratulate ourselves on having such as Dr. Carpenter for our friends.

The Corporation of Salford do not lead a very easy life either among themselves or with their neighbours. After great debate the Council have approved of the promotion of the Corporation Bill, of which notice has been given for next session. This Bill, among other things, is intended to contain clauses empowering the Corporation to supply gas, light, and heat by electricity. The matter is not particularly clear, as reported in the local papers, but at all events, the proposal to insert these clauses has aroused the most intense suspicion and discontent in the districts of Barton and Eccles. The Board entrusted with the control of these out-districts are chronically suspicious of the Salford Corporation, and have incited the ratepayers to oppose the extension of the powers of the latter body beyond the limits of the borough. To do them justice, the promoters of the Bill have expressed their willingness to meet the wishes of the objectors, and to limit the Bill accordingly. This course has not pacified the Barton Board, and they will therefore formally oppose the Bill in Parliament until they are quite satisfied that the Salford authorities will be unable to steal a march upon them in the matter in question. It does not appear, however, that the opposing Board have any more serious object in view than the preservation of the independence of their district against insidious encroachment on the part of Salford. There is no reason why the Salford authorities should desire to supply electric lighting for the outlying districts, as they will be restrained from making a profit by it, and therefore they lost nothing by yielding to the request of the Barton Local Board.

The fate of one Provisional Order, notice for which was given for next session, has been already decided. We have occasionally referred to the affairs of the Corporation of Bolton, where some difficulty has been experienced in obtaining the consent of the ratepayers to a Bill authorizing an extension of the gas-works, and containing other provisions of a general character. The statutory towns meeting, in fact, declined to support a Bill, whereupon it was considered desirable by the Gas Committee to apply for a Provisional Order for their own purposes, leaving the general Corporation legislation to some more auspicious occasion. At the last meeting of the Council it was announced that the purchase of additional land for the extension of works, which had been considered so urgent as to warrant a special application to the Board of Trade, had been deferred for a year; and thereupon the proposed Provisional Order was abandoned. The latter mode of procedure was, at best, an unsatisfactory substitute for the Bill at first advocated, and there were even doubts as to its sufficiency for the required purpose, so that there will be nothing lost by the year's delay, if it results in a future Bill of a comprehensive nature being adopted. The failure to obtain the necessary sanction to the Bill this year appears to have been due to the fact that it was presented to the Council in a very crude state, and, as alleged, took some of the members by surprise. Under these circumstances, the late *fiasco* is intelligible, if not creditable to those concerned. It may at least be said that the possibility of postponing the purchase of land for a year might have been ascertained by the Gas Committee before their abortive rush for an Order.

The arbitration proceedings now in progress with respect to the rating of the Sheppy Gas Company's undertaking by the Guardians of the Sheppy Union, involve several nice points of principle. The accounts of the Company, giving the results of their business operations, are not disputed. It is acknowledged by both sides, as the point of departure, that the gross annual receipts of the Company amounted last year to £6893, allowance having been made for discounts and bad debts. The working expenses were also taken by both sides at £3517, with the slight difference that the Surveyor for the Guardians naturally included a larger sum for rates, which would proportionately increase this amount. The gross profits were therefore taken as amounting to £3376. Beyond this stage the two contending parties began to diverge widely in their estimates of the actual rental to be given by a hypothetical tenant for the right to receive these profits from the particular concern in question. Differences arose as to the definition of the term "hypothetical tenant"—whether he should be taken as an incoming stranger, on yearly or perpetual lease, or whether the actual proprietors should be considered as tenants. The greatest contention arose as to the amount of the hypothetical tenant's capital, and the allowances to be made out of revenue for maintaining the works, and for other purposes. We must refer to the report in another column for particulars on these points, the conditions being too complicated to permit of an intelligible abstract being here given of the considerations advanced on each side. Suffice it to say that the subject on which there was most dispute was the proper allowance to be made for repairs, in view of the present state of the Company's works. Although the Directors reported last year that the establishment under their control had been kept up to a proper standard of efficiency, they were compelled to plead before the Arbitrator that such had not been the case. All their own witnesses stated that the works are in such a dilapidated state that thorough reconstruction is imperatively required, and that, consequently, the sum to be set aside for maintenance must be unusually large. It must be admitted that the necessity for pleading of this character is very unfortunate, and the admitted incompatibility of the statements of the Directors and their experts, on the different occasions referred to, must tend to the detriment of the Company in one sense, although on the matter of fact there may be no

uncertainty. Under the circumstances, it is not at all to be wondered at that Mr. Clutton, the Arbitrator, reserved his award until he shall have personally inspected the works in question.

Herr Friedrich Siemens, in a letter which we publish to-day, informs us that his regenerative lamps, of which a notice was recently given in the JOURNAL, have already been introduced into this country, and that the desire for further tests of their performance expressed by us on that occasion has, to some extent, been anticipated by the report of Mr. T. W. Keates, the Superintending Gas Examiner for the Metropolis, which will also be found in our correspondence column. We understand that Herr Siemens's lamps have long since emerged from the experimental stage, and are about to be largely manufactured in this country. It should be remarked that, according to a statement of the inventor, the failure of other attempts to increase the illuminating power of gas-flames by previously heating the air and gas supply has been due to the fact, only discovered by himself, that a special form of burner and air deflector is necessary in order to obtain all the desired effects from the heated air and gas. Other experimenters, who have remarked that the advantages of previous heating have appeared insufficient to compensate for the extra expense and trouble of such arrangements, have not only missed the point that no expense, beyond the slightly increased first cost of the lamp, has to be incurred in the regenerative process whereby the gas heats its own air, but they have also limited their experiments to the same kinds of burners as used with cold air, and they have not heated the air sufficiently. Herr Siemens's notched air deflector and peculiar burner, consisting of a ring of pipes, are, as he contends, necessary to the full development of the additional illuminating power rendered available by highly heating the air and gas. The pipes are of comparatively large area, and the flame consequently presents the appearance of an intensely luminous globe scored with vertical markings. The flame is steady, and turns downward quite regularly over the edges of the interior cylinder of porcelain. The models already in England are suited to street lanterns, and are confessedly not capable of giving results equal to those obtainable by the standard form figured in our recent notice. It is, however certain that Herr Siemens has inaugurated a new departure in the matter of gas lighting on a large scale, and in all probability his lamps, even in the present form, will be found most useful for many reasons, while it is evident that they may be susceptible of great improvement.

The paper ongas-engines read by Mr. G. G. Ramsdell at the last meeting of the American Gaslight Association, and reproduced in another column, is interesting on account of the author's manner of dealing with his subject, and also as an evidence of the extended demand for gas motors in places where gas is commonly sold at very much higher prices than are usual in this country. It is instructive, by way of commentary on the amount of competition to which the gas industry is subjected in these kingdoms, to remark that the experience of our American brethren shows that much activity is possible in pushing the sale of gas, even when it is priced at about 10s. per thousand cubic feet, and in a land where petroleum is native, and quite a drug in the market. We sometimes hear a great deal concerning the wonderful development to be expected in the general consumption of gas when it can be sold in English towns at about eighteenpence, or less, per thousand feet. While acknowledging that every reduction in price is a powerful incentive to increased consumption, it is evident, from contemporary examples, that it is not its cheapness only which causes gas to be esteemed by the public. Hence it is clearly unnecessary to expect that a new set of inducements to use gas for cooking, heating, or power will spring into existence with a greatly diminished selling price of gas. Whatever are the inducements to use gas for any purpose, they are as operative in kind, though not in extent, when gas is worth 10s. per thousand feet as when it is sold at little more than one-tenth the price. If this principle were fairly appreciated, we should hear less of specially-made gas to be sold at an abnormal figure in view of an unusual demand; and it would be more clearly perceived that common coal gas, produced under favourable conditions as to capital, is and will be as cheap as any locality may require. It would, of course, be overstating the point to say that a man who will not consume gas at current rates will be no more likely to do so if it should be reduced to only half the price; but there is a great proportion of truth even in such an extreme statement as that would be. It would, perhaps, be putting the case more fairly to say that a man who would consume gas worth eighteenpence per thousand will in all probability be a consumer when gas is sold at double the price, or more; he will only use it more freely as it is rendered cheaper.

One of our correspondents this week puts in a plea which we trust will not be altogether dismissed by those of our readers to whom it may seem to most directly appeal. It is an old grievance, heard from time immemorial, and from all classes of workers, that work and wages are frequently imperfectly adjusted to each other. The honest sailor, of the ante-ironclad era, who wished that the shot of an approaching enemy might be distributed on the same principle as the prize-money—the greater part among the officers—is the prototype of many a subordinate in more peaceable callings. There is always more or less discontent among persons in inferior positions when they recollect the difference between their emoluments and those of men above them, who have not apparently so much labour expected of them in return. There must always be these differences, and if the discontent of the poorer man takes the active shape of emulation, his comparative poverty may prove his best friend. But the disproportion need not be so extreme as is sometimes the case. The assistant or clerk must have enough, not merely to live upon decently, but to make him conscious that his position is respected by his employers. Gas Companies and Corporations owe much—sometimes more than is suspected by Directors and Committees, or admitted by the heads of departments—to those for whom our correspondent pleads. Frequently they labour, and others reap the reward which should be theirs by right. From their position they are condemned to natural seclusion from the personal notice of the supreme powers; but it is therefore the more incumbent upon the latter to see that their material interests are not neglected. To those whom it may concern—and we know that our words will not be uttered entirely to the idle winds—we would commend our correspondent's petition as one addressed personally to themselves; that to them may be the credit of giving a kindly New Year's greeting to their deserving people, as to them will belong the responsibility of shutting their ears and hearts against such an appeal.

We are pleased to notice the appointment of Mr. Robert Mitchell, formerly of Coatbridge, but at present Manager of the Dawsholm station of the Glasgow Corporation Gas Commissioners, to the position of Engineer and Superintendent of the Edinburgh Gaslight Company, vacant by the recent resignation of Mr. Barclay Henderson. The circumstance will be found referred to by our Edinburgh and Glasgow correspondents, in "Notes from Scotland" this week.

Water and Sanitary Notes.

THE Directors of the Chelsea Water-Works Company, in their half-yearly report to be presented at the meeting of Proprietors to be held on Thursday next, refer to the present position of the Metropolitan Water Question, and express their regret that it will again become necessary in the next session of Parliament to enter upon an expensive contest in defence of the Company's rights. But they have no fear as to the result, being satisfied that the terms negotiated by the late Mr. E. J. Smith for the purchase of their property were such as could be supported under an arbitration. Nearly four hundred new supplies have been laid on during the past half year, representing a future net water-rental estimated at £1252 per annum. It is remarked in reference to the extra quantity of water pumped into the Company's covered service reservoirs at Putney Heath during the six months ending September last, that considerable waste still appears to take place in the smaller class of houses where the supply is constant and the fittings are of inferior quality. In common with the Metropolitan Water Companies generally, the Chelsea Company feel the rigour of the Vestries and District Boards in raising their assessments under the Valuation Act of 1869. This, it is stated, will add considerably to the item of "rates and taxes" in the Company's accounts during the next five years. The rates and taxes paid by the Company during the past half year, exclusive of income-tax, amounted to £3733. This is an appreciable sum in relation to a balance of rather more than £20,000 to be appropriated in paying a dividend at the rate of six and a half per cent. per annum on the £615,600 of the Company's ordinary stock. The Government Auditor, Mr. Allen Stoneham, states in his certificate that the expenses incurred in respect of the oppo-

sition to the scheme of the Lower Thames Valley Main Sewerage Board, and of the recent negotiations for the purchase of the Water Companies—amounting in all to about £1700—are not included in the balance-sheet. The Directors say in their report: "It has been deemed just that the "amount should be provided for out of the contingency-"fund."

The bevy of Analysts, to whose conflicting conclusions we made reference a short time back, have excited the attention of the Metropolitan Board of Works, who being apparently at a loss to understand the various statements respecting the purity or impurity of the London Water Supply, have asked to be enlightened by their Consulting Chemist, Mr. Keates. At last Friday's meeting of the Board, this gentleman presented a report on the subject, and this having been read, was referred to the Works and General Purposes Committee. Whether it is possible to bring about a chemical concert among the Analysts, we scarcely know, but something of the kind seems very much needed. There are four Chemists at work on the Metropolitan waters—namely, Dr. Frankland, Dr. Bernays, Dr. Tidy, and Professor Wanklyn, the last-named gentleman having Mr. W. J. Cooper associated with him. The first two on the list adopt the same process of analysis, but while one expresses the results in parts per 100,000, the other takes the gallon, consisting of 70,000 grains, as his numerical basis. Dr. Tidy expresses his results in parts of the gallon, but adopts a different method of analysis from that of Dr. Frankland and Dr. Bernays; and he also differs chemically in his statement of the results. Professor Wanklyn has yet another process of analysis, and gives his results in parts per million. Comparison is thus impossible to the uninitiated, and even the professional inquirer is likely to be baffled. Mr. Keates reduced the quantities to a common denominator, with a result not altogether flattering to the analytical gentlemen concerned. In so essential a matter as the estimated quantity of organic nitrogen, the figures are found to vary immensely. The difference is fifty-fold in one case, and a hundred-fold in another. There is evidently a mistake somewhere, and it were well for the credit of science if the Analysts could agree to adopt one process and one mode of reporting. But it is hopeless to expect there will ever be an agreement between Franklandites and Wanklynites, and the most one can expect is that they will take a common basis for their figures. Unfortunately, when the denominator becomes the same throughout, everybody is able to see how completely the chemical quartette are out of harmony with each other. Somebody, we may presume, is right, but assuredly not everybody. In the meantime, Lieut.-Col. Bolton must sigh in vain for a "standard of quality" to which all Metropolitan waters should be made to conform. At present there is a "battle of "standards," and there is no sign of its ending.

It is curious to learn from a statement made at a meeting of the Vestry of St. Martin's-in-the-Fields last week, that all the agitation in that quarter with respect to the Water Supply of London was originated by "a message from the Vicar," who thought the charge for water had become "somewhat "alarming." Thus we know how the Delegates were called into existence—a body, concerning whom Mr. Watherston stated they held such various opinions that it was beyond his power to control them. Somehow or other the Delegates adopted a memorial to the Home Secretary, which was admirably adapted to damage the Vestries and the Metropolitan Board, and this having been found out, the said memorial has been kept back, and will not be presented at all. Under these circumstances the Vestry of St. Martin's-in-the-Fields have presented their thanks to Mr. Watherston for his "zeal "and energy," and are directing their thoughts to the forthcoming Bill.

The Lambeth Vestry have adopted Mr. Fowler's resolution, declaring in favour of regulation instead of purchase in respect to the Metropolitan Water Supply. An amendment, approving of a representative water authority, was rejected. Mr. Wiseman, who moved the amendment, endeavoured to justify his position by reading a letter from Professor Rogers, M.P., who was on Sir W. Harcourt's Select Committee. In his letter, Professor Rogers saw fit to say that "Parliament, "acting on behalf of the public, is not to be bullied by any "Company or Companies, however strong and however "important." This is perfectly true, but why does Professor Rogers say it? We are not aware that the London Water Companies have bullied anybody, but something might perhaps be said the other way. The Companies have been violently attacked and misrepresented, and having received it all with quietness, are now accused of having "bullied" the Legislature. If the unfortunate Mr. E. J. Smith were alive, he might perhaps express an opinion of his own on the subject, which probably would not be acceptable to Professor Rogers.

The Stockton and Middlesbrough Water Board are in a state of commendable anxiety with reference to a scheme promoted by the Teesdale Board of Guardians, as the Rural Sanitary Authority of Gainford, for erecting certain sewage works on the banks of the Tees. The scheme is objected to as likely to imperil the purity of the water supply. What degree of purity attaches to the supply at the present time, we do not know. At one time, when the supply belonged to a Company, the Local Authorities made many complaints on the question of quality, but when the supply came into their own hands, the Authorities considered it would cost too much to attempt a gravitation scheme; consequently they have since drawn from the river. Whether the sewage discharge from Barnard Castle, and the waste from the lead mines, together with all other sources of pollution above the intake, have been duly dealt with, we hardly dare to say. We should presume that everything of this kind has been intercepted and disposed of, otherwise we can scarcely account for the alarm which is excited at the prospect of the purified sewage of a rural district finding its way into the stream.

The Lower Thames Valley Main Sewerage Board are earnestly debating as to the course which they are to pursue in order to dispose of the sewage of their district. A discussion of nearly four hours duration which took place last week, led to a rejection of two amendments, and the further consideration of the original motion was then adjourned. The Board apparently despair of getting the approval of the Local Government Board to any scheme of irrigation, and in this they are doubtless right, on account of the violent opposition which any such scheme is likely to provoke in a district of so residential a character. It is thought to be not quite so certain that the Local Government Board would reject a scheme of precipitation, but it is argued that if precipitation be adopted, it could be carried out on a small scale in each neighbourhood, and the Joint Board might just as well be dissolved. Kingston has already asked to be released, and although Mr. Dodson has not indicated any disposition to favour this request, it is formally under consideration. The Local Government Board are evidently favourable to the project of Sir Joseph Bazalgette for diverting the whole of the sewage of the Lower Thames Valley into the West Kent Board's system, and the Sewerage Board seem to have no alternative but to adopt that scheme. An important announcement, which rather interferes with the project, was, however, made to the Sewerage Board at its recent sitting, by their Chairman, Sir T. Nelson. The Port Medical Officer of London has reported to the Corporation that in the month of July last the River Thames was in a very unsatisfactory state from the presence of sewage, the smell being at times "almost "intolerable." Numerous complaints are said to have been made by persons afloat and ashore, and especially by ship captains. The annoyance was greatest at Woolwich and Barking, and when the West Kent outfall comes into operation about twelve months hence, it is expected that the nuisance will be still greater. What all this means remains to be seen.

We notice that the Rustless and General Iron Company (Messrs. James E. and Samuel Spencer) have removed their offices to 3, Queen Street Place, Cannon Street. Also that the London offices of Messrs. John Abbot and Co., Limited, of Gateshead-on-Tyne, are now at 106, Cannon Street, Messrs. Coates and Co. being appointed their Agents for the South and Midland districts of England.

The Sheffield Corporation and the Water Company.—At the last meeting of the Sheffield Town Council a Committee was appointed "to consider the Bill of which the Sheffield Water-Works Company have given notice; to watch the proceedings of the Company in their promotion of such Bill; and to report to and advise the Council thereupon—with power, if necessary, to present a petition, in the name of the Council, against such Bill." It was stated that the Company would be approached in a friendly spirit, and a petition might not be necessary; but of course no expense could be incurred in regard to any petition without the sanction necessary under the Municipal Corporations (Borough Funds) Act.

The Use of Water Gas in Canada and the United States.—The *Toronto Mail* of the 25th ult., under the heading of "The Poisonous Gas Committee," gives an account of the meeting, on the previous day, of a special committee which has been appointed to inquire into the quality of the gas supplied to the city. In the course of the proceedings the Chairman (Alderman Walker) stated that he had received a letter from a gentleman well versed in the qualities of gas, in which he stated that the gas now supplied to the citizens of Toronto should be prohibited by parliamentary enactment. In New York alone no less than nine deaths had occurred within the past two years from gas poisoning, and as many more not reported, while numerous cases had appeared elsewhere; and, further, that every solitary death in New York had occurred where water gas was used. Since water gas was supplied in Toronto (in January, 1879) six deaths had taken place from it, and in addition several other cases had proved nearly fatal. He further stated that a law had been passed in Massachusetts prohibiting the sale of the so-called water gas. After some discussion the matter was referred to the City Solicitor to report upon the city's power to deal with the matter.

THE ENCOURAGEMENT OF GAS CONSUMPTION.

SECOND ARTICLE.

WE noticed last week, under the above heading, certain causes specially operative at the present time in directing attention to the important question of extending the uses and the consumption of gas. We return to the subject in order to mention some of the ways by which this generally desired object may be attained. Last week the advantages that would accrue to gas makers from the pursuit of the policy advocated were incidentally dealt with; and we may to-day be permitted shortly to revert to this topic.

It may be stated broadly that the profits arising from any growing business will increase in a greater ratio than the gross returns; because, at least in the great majority of instances, it is more economical to manufacture on a large than on a small scale. What is true generally is true in the case with which we are interested; an increased consumption of gas enables a Gas Company to reduce the selling price, and a reciprocating action is set up, the reduced price causing a further increase of consumption. Thus the cause and effect continue to act and react, to the mutual advantage of user and producer. This is the case with old and new Companies alike. With the latter the effect is due partly to the more effective occupation of the plant, and partly to the diminished proportion which many charges of a more or less fixed character bear to the larger rental; with the former the more economical construction of the works required to meet the larger demand is chiefly to be credited with the lessened cost of the additional supply. In such works the advantages of improvements in manufacture, tending to cheapen production, would be equally applicable to old business and to new, and they do account for much of the steady reduction apparent in the cost price of gas. But the new business is not weighted with the heavy capital charges which attach to the old, and for this reason is proportionately more valuable. Let us suppose the case of a town where the price of gas is 3s. 6d. per thousand cubic feet, that price including, say, 1s. 2d. per thousand cubic feet for interest or dividend. This is a proportion not unusual, and most of our readers will be able to supply themselves, from their own experience, with an illustration very near it. Now, such a charge for dividend is no longer necessary with the lessened cost of much of the apparatus employed, more definite knowledge on the part of engineers of exactly what and how much plant they need to provide, and also the reduced charge at which, under the operation of the auction clauses, the necessary money is raised. In most towns of even moderate size, where ordinary maximum dividends are paid, new business can be met by an expenditure of capital which will not involve a greater burden than eightpence per thousand feet, and sometimes materially less. Here, then, is a difference of sixpence per thousand feet—a saving equal, let us say, to the payment of very nearly the whole of the labour employed in the production of gas and its delivery into the holders. This may be regarded as so much premium to the producers upon new business. In the ordinary case of a consumption doubling in eight or ten years, it alone would effect a reduction in price of threepence per thousand feet over the whole district within the same period.

Such an advantage as this, and others which will suggest themselves—as, for instance, the greater economy of fuel in large as compared with small works, the profit to be derived from the treatment of residual products, &c.—applies to an increase of business obtained on the ordinary lines, where the vastly greater proportion of the gas is used for lighting purposes, and its consumption limited to the hours between sunset and midnight. It has with many people become rather the fashion lately to discuss the position of the gas industry when gas has ceased to be the great illuminating agent—when, in fact, that honourable vocation has been assumed by another, and gas is relegated to the still useful, but much less ornamental purposes of heating, cooking, and the like. Some Chairmen of Gas Companies have contemplated this change "with a light heart," which may have been as real as it looked. It is, however, more from those "good-natured "friends" who want to administer a pill and at the same time take credit for a sugar-plum, that we receive most of this kind of encouragement or consolation, as the case may be; and we feel under no oppressive weight of obligation to them in return for it. It will be the commencement of a bad time for gas makers when they have to find other outlets for their chief product, not for the sake of increasing their returns, but to make up for losses sustained in their, at present, most important and useful field.

While we say this with all possible emphasis, we yield to none in the earnestness of our desire to see each of the uses of gas cultivated to the utmost, and our expectation as well as hope is that the percentage of the total quantity of gas made which will in future be used for purposes other than lighting will rapidly increase. We have already referred to the lessened charge upon the gas for dividend on capital required to meet ordinary extension of business, and pointed out that it is by no means trivial. But when considering a development of this kind, where the demand would be chiefly in the daytime, and to that extent would call for barely any increase upon one-half of the capital employed—that sunk in gasholders and distributing plant—the economy in dividend charge is still further augmented. Added to this there would be further saving in leakage and the proportionate charges for distribution, management, collection, &c., all combining to make a day consumption of much more value to a Gas Company than an addition of the same rental value obtained from ordinary lighting sources. It would be palpably erroneous to say that it is more profitable to supply gas in the daytime for working an engine or cooking a dinner than to supply an equal quantity at night for purposes of illumination. Yet at the same time there is much to recommend the idea of charging a lower price for gas used for the former and like purposes. Gas *light* is at present an indispensable necessary in our towns, and consumers have no choice as to those from whom they will buy. Gas-engines, on the other hand, will only meet with acceptance as they are able, in comparison with steam-engines, to develop points of economy or other advantage, and similarly gas stoves as against ranges heated with coal or coke.

We believe we are not over-estimating the advantage of this day consumption "found," as it were, and added on to the work of a Gas Company, at one shilling per thousand feet. If, therefore, the obtaining of this business will enable the Company to produce more cheaply, it is not unreasonable that some inducement should be offered to secure it; and a reduction in price of, say, sixpence per thousand feet would offer such inducement, while leaving a balance to be applied in cheapening the cost of gas for lighting purposes. On this point the experience of the little Danish town of Nakskov, as told in the JOURNAL* eighteen months ago, is instructive. A differential price has been there instituted, with the result that in 1878 forty-eight per cent. of all the gas sold was for cooking and heating purposes, while in the summer quarters the proportion used for this purpose exceeded rather considerably that for lighting. The laying on of special services to stoves would somewhat reduce the economy in capital expenditure, but it would be amply repaid, and would have further and great advantage on the score of efficiency. Very much can be done to popularize and extend the use of gas for these subordinate purposes, without necessarily reducing its price. Gas Companies and Gas Committees should put off, at least in this direction, the monopolist, and put on the trader, taking their wares to the consumer rather than waiting for him to be enlightened, in some accidental or extraneous manner, as to their value, and so come unsolicited to buy. We have offered no stinted praise to those who have sought to do this by opening exhibitions of gas apparatus, and to others, more numerous, who have adopted—some for many years past, others quite recently—the plan of selling or letting on hire stoves for heating and cooking. Good as these efforts have been, they are yet wanting in permanence or completeness. The best model hitherto furnished is that of the Paris Gas Company, which may once more be commended to our readers. The exhibitions should be *permanent;* the consumer should be enabled to see the best apparatus for the purpose he needs, and to know, on the authority of the Gas Company, at what cost the work required can be done; and experiments should be made for the purpose of weeding out the extravagant and offensive appliances, which cause dissatisfaction to the consumer, and discredit to the Company, and of bringing into prominence those that are really excellent. Another point of still greater importance is that the stoves or other apparatus, when fixed, should not be lost sight of by the supplier. Not only should the user be instructed how to keep his stove in proper order, but his consumption of gas should be watched, and assistance given to keep it within proper bounds. The excellent stories told by Mr. Travers, of the Cork Gas Company, in his papers read at the last two meetings of the British Association of Gas Managers, well illustrate the importance and advantage of such attention. The first obligation which has to be met is that of instructing the public as to the great advantages to be derived from gas; and, while we are grateful for such help as is

* See Vol. XXXIII., p. 991.

afforded in this direction by men like Dr. Siemens and others, for their recent advocacy of the extended use of gas, the obligation presses primarily upon Gas Companies, and is due by them both to their shareholders and to the public. The work would have this advantage in their hands, that while private traders would be chiefly concerned to make an immediate profit by the sale of their goods, Companies would regard this as a secondary object to that of providing and selling such apparatus as would be likely to prove permanently satisfactory to the users. But if the Gas Companies in London and the gas makers—Companies or Corporations—in other large towns are unwilling to undertake this task themselves, they will find it easy to obtain the assistance of others willing to help them in this direction, and work practically under their control, in return for such aid as could be readily afforded. This view of the matter will, we hope, receive increasing attention.

In this direction, then, we hope to see a large development of the use of gas. At the same time much remains to be done to give it full scope for its original and chief purpose—that of lighting. Vexatious hindrances to its introduction should be removed. For instance, what possible excuse can be offered for the practice of compelling a consumer to fix his own meter "because the Company are afraid of the responsi-" bility for explosion"? The possibility of such a disaster is thereby thrust upon the consumer, and he is required to accept responsibility, increased greatly by his having to employ workmen certainly less skilled than the Company could readily supply. This and other impediments would vanish at once if the line now drawn at the entrance to a consumer's premises were abolished, and the Gas Company undertook to enable their customers to get the full benefit from that which they buy. Much has been done to put good burners within the reach of consumers, but the average gas-fittings of to-day are probably as faulty as they were ten years ago. Considerations such as these open up a most promising field for the enterprise of gas makers, by whom the great advantages it offers should be speedily enjoyed.

THE GAS SUPPLY OF PARIS.

An agitation for cheap gas, as our readers are aware, has been lately carried on in the French capital, and the latest phase of the dispute between the Gas Company and the Municipality is very fully set forth in the last number of the *Journal des Usines à Gaz*, from which, as the subject is of some interest in its incidental illustration of the conditions under which the gas supply of Paris is maintained, we extract a few matters for comment.

The Paris Gas Company enjoy their position by virtue of a concession originally granted by the Municipality in 1855, renewed in 1861, and again in 1870. This concession gives to the Company for a term of fifty years, dating from July 1, 1856, the exclusive right of laying mains in the public thoroughfares for the distribution of gas for the purposes of lighting and heating. During the term of the concession the Company are required to deliver gas to any person who may require it, at the fixed price of 30 centimes per cubic mètre (about 6s. 6d. per 1000 cubic feet). A duty of 2 centimes per cubic mètre (about 5d. per 1000 cubic feet) is payable to the Municipality on the total consumption of gas, and also a yearly rent of 200,000 frs. (£8000) for the subsoil occupied by the Company's mains. The Company are also compelled to supply at half price the gas for lighting the streets and public offices, and to maintain the public lamps belonging to the Municipality. Besides all this, any profits realized by the Company over and above a certain amount are divided between the Company and the Municipality, and at the expiration of the period of the concession the mains and works are to become public property. Thus it will be seen that the Company's customers have to pay for a number of other things besides gas. However, the price of gas has for some time been much grumbled at in Paris, and in the early part of the present year the Municipality took steps to appease the public clamour—not by meeting the Gas Company with a view to the redistribution of some of the burdens which virtually make the Company collect a large proportion of the corporate revenue, but by calling upon the Government to appoint a Commission of experts, to examine the process of manufacture carried on by the Company, with a view to determine whether, as alleged by some of the malcontents, the said process has been of late years so much improved as to bring the Company under the provisions of another stipulation, contained in the concession, to the effect that the public should participate in any benefits accruing to the Company by the adoption of any remarkable improvement in gas manufacture.

It was stated, in certain memorials upon which the action of the Municipality was based, that in many respects—particularly with reference to the treatment of residuals—such improvements had been introduced since the Company obtained their first concession as to materially reduce the cost of producing gas, but in consequence of which, so far from granting any reduction in the selling price of their gas, the Company had merely put so much more profit into their own pockets. On the face of it, the action of the Municipality was not very sensible, for they must have known that so long as the Company fulfilled the terms of their contract, and divided the surplus profits with them, the desired reduction of price could only result in diminishing the annual subsidy received by the City from the Company. It certainly looks very much as if, following the bent of public bodies all over the world, the Municipal Council wanted to get their usual share of the plunder, and yet throw the onus of supplying dear gas upon the Company. We are assured by the contemporary press that in the course of the agitation against the Company, in which, for the sake of popularity, many Municipal Councillors took part, the benefit derived by the public treasury from the existing arrangements was carefully kept in the background.

In demanding an inquiry, the Municipality acted within their right, and the Commission was appointed, and conducted their labours in a conspicuously fair spirit. To begin with, they declined to carry their inquisition further back than 1870, when the present concession was signed, so that the inquiry became limited to a comparison between the process of manufacture as carried on by the Company in 1870 and 1880. This decision was a great blow to the agitators, who wished for an inquiry extending back to the date of the original concession in 1855, for, as they contended, the later documents merely re-enacted the provisions of the earlier agreements, no fundamental examination of the process of manufacture having been made from the first. The Commission, however, stated their conviction that the fairness of the price fixed in 1870 must have been well ascertained at the time, and that therefore they could not take cognizance of anything anterior to that settlement.

The Commission have submitted an exhaustive report, which will be translated and published next week, on the comparative working of the Company in 1870 and 1880. It should be stated at once that they have failed to discover any radical improvements as having been introduced into the manufacture of gas in this period, with the effect of cheapening to any noticeable extent the cost of production. As to the conversion and sale of residuals, of which so much had been said, the Commission found that no particular changes had taken place in the treatment of these products within the time specified, and, on the other hand, that the increased value of residuals did not come within the terms of the clause cited, as improvements affecting the cost of the production of gas. On all points the Commission reported in favour of the Company; so that the matter remains *in statu quo* pending a revision of the concession, to which the Company, with certain stipulations, express themselves willing to submit.

The detailed "study" of the Commission on the minor improvements and alterations introduced during the last ten years by the Company in their method of working, is instructive. It is shown that the average yield of gas per ton of coal has gradually risen from 1863 to 1879, the results of last year's working being 7 per cent. better in this respect than was usual before 1870. This improvement is ascribed to various causes, among which may be named the better retorts used, more perfect exhausters, and a better mixture of coal carbonized. High heat and quick charges are also credited with some of this additional yield. The charges have also been made heavier, in consequence of the heat (2200° Fahr.) at which the retorts are now worked. The more perfect control of the heat is also looked upon as a recent improvement. Much of the advancement in carbonization is due to the Siemens furnaces adopted by the Company, but anterior to 1870; since, however, having been much extended. It appears that the advantage is not altogether on the side of the Siemens furnace as compared with furnaces and settings of the ordinary construction, owing to the fact that the cost of erecting the former is much greater than that of the latter, an excess not quite covered by the saving in fuel. In the process of condensation, the apparatus of MM. Pelouze and Audouin is said to be a great improvement, dating from 1874. By the action of this apparatus, as adopted by the Company in all their stations, the subsequent chemical purification of the gas is facilitated, and a certain economy results, but not of sufficient moment to affect the selling price.

The treatment of residual products by the Company has for many years been very thorough. Almost every conceivable use to which these products could be put has been experimentally taken up by the Company at different times, and with varying success. Some of these processes have been abandoned, but tar and ammoniacal liquor are still fully treated. It appears that the profit on all the secondary products of gas represented in 1869 the small sum of 0·0747 fr. per cubic mètre of gas. The proportionate value rose in 1875 to 0·1047 fr., which was the maximum, the present value being 0·0786 fr. The Commission consider the conversion of residuals in the light of a distinct industry, though carried on by the Gas Company on their own premises, but which might be carried on elsewhere; and for this reason they decline to recognize it as an integral portion of a gas undertaking. It is shown that the production of anthracene and other derivatives of tar was practised before 1870, and that, in fact, the value of the more recondite hydrocarbon compounds has a general tendency to diminish instead of increase, in consequence of the quantities now thrown upon the market.

In conclusion, it may be said that the report is strongly tinged with the reflection of the Gas Company's statements, and although these are, of course, perfectly trustworthy, it is too much to expect of the Municipality that they should accept the Commissioners remarks as terminating the difficulty. It now remains for the Municipal Council and the Company to reconsider the general question, and to arrive at some mutual agreement as to the price of gas and the disposition of the profits of the undertaking, which shall be more in unison with modern ideas than the organized blackmailing of the present concession.

THE PURIFYING PLANT AT THE JARROW GAS-WORKS.

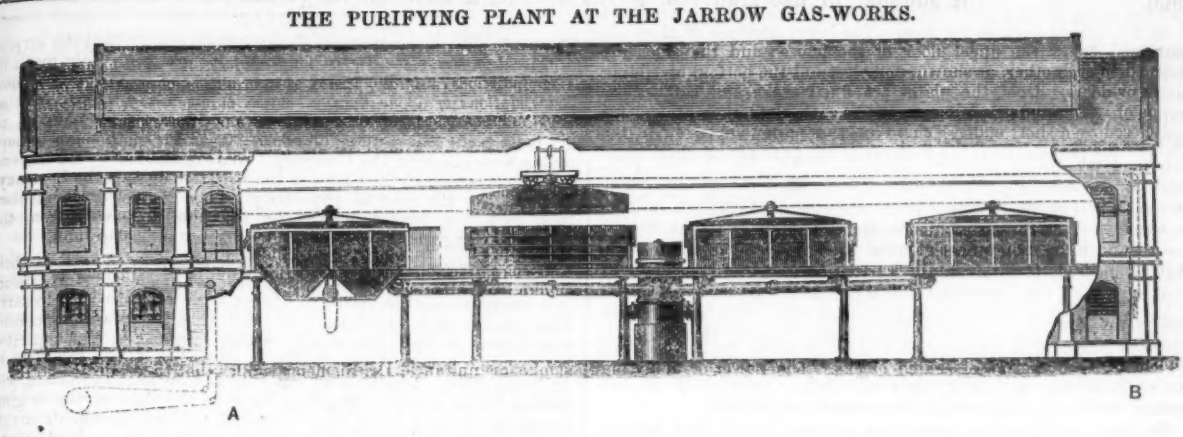


FIG. 1.

The accompanying engravings show the general arrangement of the purifying-house at the new works of the South Shields Gas Company, at Jarrow, and which, when reporting the proceedings at the last meeting of the North of England Gas Managers Association, it was promised should form the subject of early description and illustration. There are several points of novelty in this arrangement, which was designed and carried out by Mr. W. J. Warner, the Company's Engineer, and at the various gatherings of gas managers and others that have taken place at the Jarrow works, considerable attention has been attracted to the machinery and its surroundings.

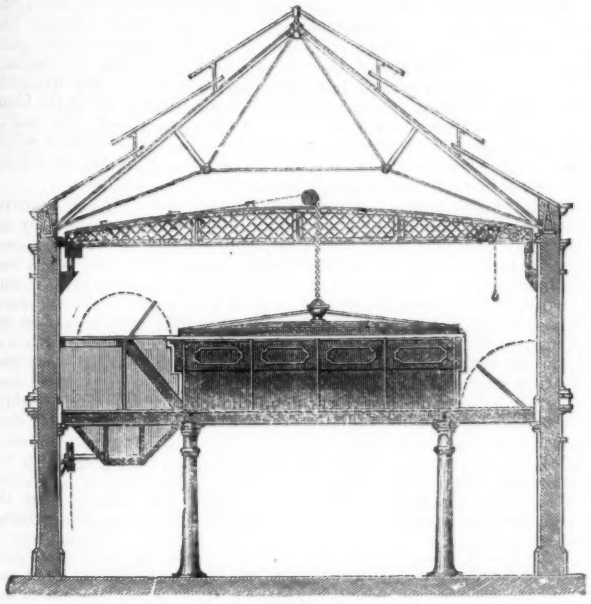


FIG. 2.

Fig. 1 shows an elevation of the purifying-house, with a large portion of one of the side walls removed, to allow the general arrangement of the plant to be seen; a cross section of the house is shown, on an enlarged scale, in fig. 2; while half of the house in plan, and the basement of the engine-room, also on an enlarged scale, are represented by fig. 3. The dimensions of the purifying-house, inside measurements, are—length, 120 ft. 6 in.; breadth, 35 ft.; height to eaves, 27 ft. 6 in.; height of basement to under side of girders, 11 ft. The engine-room is the basement of the exhauster-house, but we confine ourselves to the purifying arrangements.

The structure may be described as a composite building—concrete and a common class fire-brick. The walls are cut up by brick pilasters into bays of concrete; are divided horizontally by plinth and string-course of fire-brick; and are finished by an entablature of the same material. Each bay is panelled and rendered; and the interior is the same as the exterior in design and finish. The composite character of construction is extended to the roof; the principals or framing being of wrought iron, while the covering is carried by common rafters of wood, which may be said to be bolted to an angle-iron framing of purlins, dividing the roof into three sections, each being raised above the other. The covering is raised above the framing, and formed of Wade and Cherry's patent interlocking tiles laid on stout laths of wood. As the roof covering is raised above the framing, it is made easy of access for painting; and at the same time durability and ventilation are attained. With the open roof, louvre glazed windows are employed, which may be said to complete the ventilation. The tiles have been dipped twice in silicate Zopissa paint, which, with attention to other details, coupled with the hard and smooth nature of the walls, will undoubtedly contribute to the durability of the structure. In a district such as that in which these works are placed—amongst metal and chemical works—this should be aimed at.

The purifiers, which, with the roof, were erected by Messrs. C. and W. Walker, are 20 feet square by 5 feet deep, with planed joints. They are supported by cast-iron columns and girders, as shown. The centre-valve is faced, and has double covers, the same as was invented by Mr. Warner some years since, and was referred to in his "Notes on Purification," read before the North of England Association at Sunderland last October. By means of this valve entire control is obtained over the working of the vessels. By referring to the engravings, it will be seen that on one side of the purifiers are enclosed spaces, which form chambers, and are for the reception of the spent

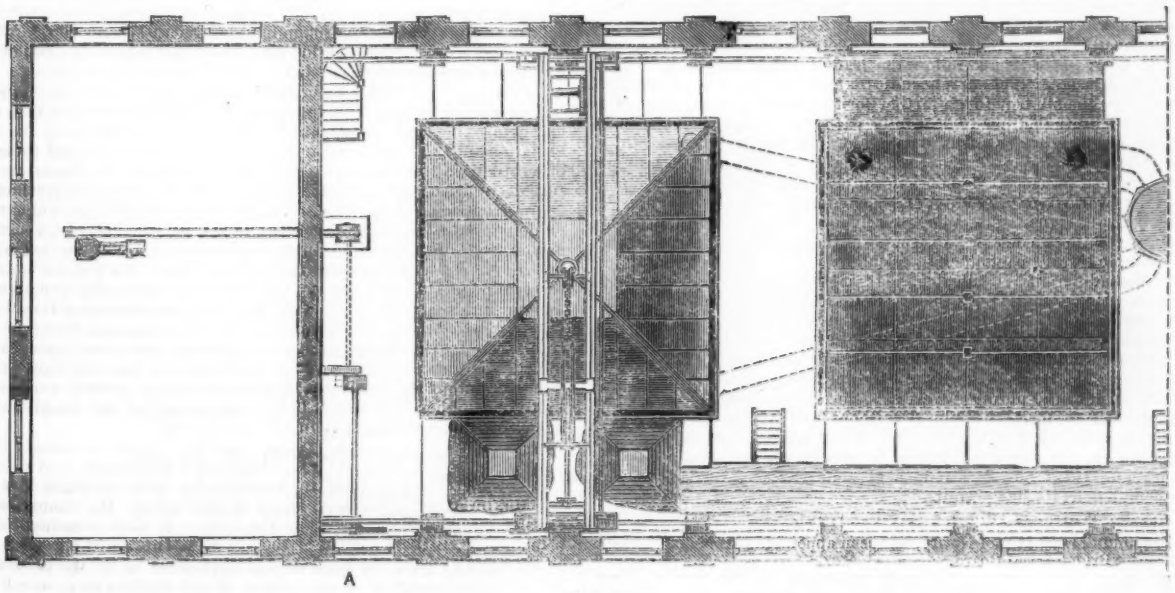


FIG. 3.

material when thrown from the purifiers. These hoppers are closed in by the hinged flaps on the tops. The lower portions of them are continued below the upper floor of the house; and the sides are inclined to each other, as shown, and closed at the bottom by sliding plates or doors. Upon the plates are fixed racks and catches, by means of which and a pinion geared to each plate, they are opened and closed by a short endless chain over a pulley keyed on to the shaft of the pinion. Thus the contents of the purifiers are discharged —if lime, into a cart or truck for removal; if oxide, to be worked slowly down an inclined shoot for revivification. On the other side of the house to the hoppers there are, the whole length of each vessel, trap-doors through which material is raised to the purifiers.

Just under the roof, on each side of the house, and extending the whole length of it, are steel rails, carried by cast-iron brackets built into the walls. On these rails runs the travelling crane. Its work is the lifting and carrying of the purifier covers, lifting the purifying material from the lower floor to the purifier level, and distributing it over the grids. The crane is also used to move the valve-covers, which it does by means of snatch-blocks. The powerfor actuating it is obtained from one of Tangye's "Soho" engines of 6-horse power, fixed in the basement of the exhauster-house; and it is transmitted to the crane by belting and an endless rope or cord passing over a V-grooved wheel, A, figs. 1 and 3, and pulleys at B, fig. 1, one of which is weighted, as shown, to put a tightening stress on the cord. This runs at a very high speed, and passes between three other pulleys of the same form of groove, so as to give the required power and motion to do the work. Four distinct driving and reversing motions are required. Three of these are obtained by simple friction gear—millboard bowl between two metal discs. The speed for travelling is reduced by worm and worm-wheel, which drives the crane in the usual way. For the lifting and lowering of the cover a screw is employed with a forked cross-head attached to a chain carried over a pulley; the whole being placed between the lattice girders, as shown at figs. 2 and 3. For traversing the load of purifying material a monkey is used, running between the girders, and driven by a cord. An endless cord is used for effecting the lifting of the load, which is done by the cord passing over a V-grooved pulley, on the shaft of which is a worm taking into a wheel keyed on to the barrel of the monkey. About a ton of material is lifted at a time, the discharge of which into a vessel is entirely under control.

The whole of this apparatus has been in use since the works were started, about eighteen months ago. The makers of the crane are Messrs. Wren and Hopkinson, of Manchester, and it is the joint production of Mr. Warner and this firm. It will be remembered that the same application of power to a travelling machine was described as being employed by Mr. Warner for driving his charging and drawing machine, and is equally satisfactory in both cases.

Between the old arrangement of house, crane, and working, and the present system, in a house with machinery such as we have described, there is a great contrast. The refinement of operation is well marked. The changes may have been slow, but progress has been made—progress in operation as in manipulation; and the skill required for the one will ensure the other. Thus will be promoted the introduction of apparatus and machinery that will improve and cheapen the manufacture of coal gas.

THE DESIGN AND CONSTRUCTION OF ENGINEERING WORKS.*

Mr. Campin's work forms a valuable addition to the well-known series of cheap technical books published by Messrs. Crosby Lockwood and Co. Although so much has been written on the subject of designing works of construction, and of the strains to which they are exposed, there is always room for contributions to the existing stock of a civil engineer's theoretical lore, especially when such additions are calculated to simplify the solution of the important problems with regard to stability and strength with which engineers are daily concerned. The present work is complete and authoritative as far as it goes. It does not follow the lead of the so-called elementary technical books, which merely indicate the outlines of their subjects, and leave the student to go farther for thorough information. It is intended by the author to deal fully with the matters included in its range, and it fairly succeeds in doing so. The author is not afraid to treat some very complex investigations of strains, &c., by simple arithmetical methods. He does not give a single formula which may not be worked out by any one acquainted with the meaning of algebraical signs, and able to solve a simple equation. This is in striking contrast to some authors, according to whom a simple wall cannot be calculated out without indulging in the differential calculus. It is, however, a feature on which Mr. Campin is to be congratulated, as it will tend to render his work intelligible and useful to a wide circle of practical men and students, who would turn with despair from the abstruse formulæ of Rankine. Mr. Campin's diction is clear and incisive, although he is guilty of the pedantry of adhering to the Latin form of the plural of "area." Surely this word is sufficiently Anglicized to form the plural without the awkward diphthong. This is, however, a minor fault which can easily be pardoned. Mr. Campin has some excellent advice to give on the proper execution of work, and the tables of strength of materials, &c., render the book as complete as its size permits.

Mr. John Marsland, of Newry, has been appointed Gas Manager to the Sowerby Bridge Local Board.

* "Materials and Construction." By Francis Campin. London: Crosby Lockwood and Co. 1881.

Notes.

[*This column is intended to contain miscellaneous memoranda on topics of general professional interest to our readers. We shall be glad to receive for insertion in it any scraps of information, observations of facts, or descriptions of apparatus, &c., which may be worth publication, and yet may not be considered suitable for our "Correspondence" column.*]

Dr. C. W. Siemens's Gas Fire.

In the number of *Nature* for Nov. 25, Dr. Siemens replied to several criticisms on his gas and coke fire, as described in a recent "Note," and also mentioned a simpler and cheaper arrangement intended to secure a certain regenerative action with less expense than that of the copper frill and plate as originally illustrated. To the objection that coke gives off gases almost if not quite as injurious as the coal smoke it is intended to supplant, Dr. Siemens replies that the only gas would be carbonic acid, which is a necessary ingredient in our atmosphere. The same critic having advocated the use of asbestos in lumps, heated by gas, as a perfect form of gas fire, free from all smoke or nuisance, Dr. Siemens replies that theoretically 56 lbs. of coke, costing on an average less than 5½d., will develop as much heat as 1000 cubic feet of gas, costing 3s. 6d., thus showing the advisability of making the coke do as much work as possible. He also states that as the existing gas-works produce gas and coke very much in the proportions in which they would be required were his fires to become universally adopted, the regular consumption of both products would help each other, and the gas companies would be able to keep up the supply of the two commodities conveniently, and consequently cheaply. Mr. T. Fletcher, of Warrington, having claimed great superiority for the improved Abbotsford fire-grate, with close fire-tile backs, sides, and hearth, in comparison with which he says the proposed gas and coke fires would fail to show any economy, Dr. Siemens denies the transcendent merits of these grates, and, in further reply to Mr. Fletcher's allegations as to the cost of the copper regenerative plates, he goes on to describe his modified plan. Briefly, Dr. Siemens retains the gas-pipe just inside the lowest bar in front of the grate, and fits a cast or wrought iron plate in the back of the grate, united with a dead plate extending over the bottom bars to within a short distance of the gas-pipe. Three brackets unite the back and bottom plates, just as a cast-iron tank-plate flange is bracketed between the bolt-holes. The front edge of the bottom plate is vandyked or notched to a depth of an inch or more, to allow space for ashes to drop down. The dead plate does not lie directly on the bottom bars, but has on its under side a series of ribs running from the back plate to the front of the notches, thus providing as many channels for air to pass freely along to the gas-flames. Hence it will be seen that when the dead plate is heated by the glowing coke lying on it, the air channels below are correspondingly heated, thus warming the air in its way to the point of combustion. If the fire-grate can be removed, the ribs underneath the dead plate may be made much deeper, and may then be covered in front by a shield; the back plate being, of course, carried down to an equal depth. The arrangement is made more perfect by the use of the shield in front of the air channels, which acts by directing the air more closely upon the heating surfaces. Dr. Siemens disagrees with the general tendency of grate builders of the present day, who look for economy to brick linings, as forming hot radiating surfaces. He maintains that this effect is obtained at too great a cost of fuel, and that superior economical results will be obtained by abstracting the heat from the back of the fire, where it is wasted, and concentrating it upon the purely carbonaceous material in front of the same, thus sending as much radiated heat as possible into the room, with the loss of but little by the chimney.

The Ignition Temperature of Gaseous Mixtures.

At the meeting of the Académie des Sciences on the 15th ult., MM. Mallard and Le Chatelier submitted some observations on the ignition temperatures of certain gaseous mixtures. The explosive mixture of oxygen and hydrogen fired between 977° and 1057° Fahr.; the temperature being only lowered about 85° when the proportion of oxygen was increased one-half. The addition of nitrogen to the mixture made very little difference to the temperature of ignition, but carbonic acid slightly augmented it. An explosive mixture of carbonic oxide and oxygen took fire at about 1200° Fahr. Great variations in the relative proportions of carbonic oxide and oxygen only produced the slightest discernible differences in the temperature of ignition; but carbonic acid augmented it very remarkably. Nitrogen affected it but slightly. The slow combination of carbonic oxide is producible at temperatures much below that of its active combustion. Explosive mixtures prepared with hydrogen protocarbonate present a most interesting phenomenon. They are not only susceptible of slow combustion, but also, when subjected to a certain temperature, they are capable of igniting, *after the expiration of a variable period*, longer in proportion to the lowness of the temperature. The ignition temperature of such mixtures is not well determined. Although doubts exist as to the exact temperature at which a mixture of air and hydrogen protocarbonate will take fire, it is certainly not higher than 1455° Fahr., and the effect may be produced at temperatures far lower than this maximum.

The Maxim Electric Lamp.

A considerable amount of interest is being centred, in America, in the Maxim electric lamp. This lamp belongs to the incandescent class of electric luminants, as do the Swan and Edison lamps. The principle of all these devices is the same—a thread of carbon in a closed glass globe is rendered strongly luminous by the resistance it offers to the passage of a powerful magneto-electric current. It is essential to the endurance of the carbon thread that it shall be pro-

tected from all contact with air, in which it would be consumed. Both Swan and Edison seek to secure this object by exhausting the air from the interior of the globe, but in spite of all possible precautions the process is far from satisfactory. The residual air left in the globe after the most careful exhaustion, or that which leaks in from the external atmosphere, sooner or later causes the necessarily fine carbon wire to burn through at its weakest point, and then the lamp is, of course, rendered useless. It should be remembered that it is impossible to strengthen the carbons in any way; the thinner they are made, the less current is needed to develop the required light, so that the essence of the successful working of lamps of this class lies in making the carbons as thin as is consistent with continuity. They are, in fact, made of about equal diameter to a horsehair. Hence arises the difficulty that with the thinness of the carbon increase its efficiency and its liability to destruction. It is evident that an incandescent electric lamp, certain at some unknown period to suddenly break down, is open to the same objection as applies to the arc light—it is impossible to depend upon its action from one minute to another. Mr. Maxim endeavours to prevent this tendency to sudden collapse by first exhausting the lamp-globes of air to a certain point, and then filling them with the vapour of gasoline. By a singular action the decomposition of gasoline by the current deposits carbon upon the carbon filament at the point where it is thinnest, and therefore hottest. In consequence of this remarkable effect of gasoline, the carbon becomes self-correcting, and of practically unlimited endurance. The carbon deposited is identical in character with the substance formed in gas-retorts, and is produced in precisely the same way—by the exposure of a highly heated surface to an atmosphere of hydrocarbon gas. The Maxim lamps are intended for use in apartments, &c., where the units of light are not required to exceed the illuminating power of an ordinary gas-burner; but one of the most striking peculiarities of these lamps is their capacity of being increased to almost any required power. Expressed in electrical terms, a Maxim lamp of 50-candle power was found by Professor Morton to require, when in full action, a current of 4·07 webers, giving about 5½ such lamps to every horse power of energy of the current. Allowing for the average for all positions, and for the loss of energy due to the dynamo-electric machine, it therefore appears that these lamps actually give about 115 candles illuminating power for every indicated horse power developed by the engine.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

SIEMENS'S REGENERATIVE GAS-LAMPS.

Sir,—Happening to be passing through London, my attention has been drawn to an article in your Journal of the 7th inst., entitled, "Siemens's Regenerative Gas-Lamps," in which you express a desire for keen examination by English gas engineers, so that some explanation may be added to the report of Herr Hasse's tests in Dresden. These tests, although not yet published, have been made, and I shall be very happy to afford facilities to any gas engineer in this country to satisfy himself upon the matter.

Previous to the sale of my French patents, my lamp was tested by M. Brissac, of the Paris Gas Company, and found by him to be 110 per cent. better than any gas-burner known there. Again, previous to the disposal of my English patents, ten complete photometrical estimates were made by Mr. T. W. Keates, F.I.C., Consulting Chemist to the Metropolitan Board of Works, and Superintending Gas Examiner to the Metropolis, giving as the result that for every 26 feet of 16-candle gas my lamp gave the light of 145 standard sperm candles of six to the pound.

Friedrich Siemens, of Dresden.

Charing Cross Hotel, London, Dec. 13, 1880.

[Enclosure.]

Report upon the Results of Experiments made with the Regenerative Hot-Air Gas-Burner constructed by Mr. F. Siemens, of Dresden.

This is a burner of large size, intended to consume about 22 cubic feet of gas per hour. It was, however, found that that consumption of gas was rather too low, and that better results could be obtained by somewhat increasing the quantity. Accordingly the photometrical trials were made with a consumption of 26 cubic feet per hour.

The results of the experiments were adjusted, by calculation, to 16-candle gas, and to a consumption of 26 cubic feet per hour.

Ten complete photometrical estimations were made, the mean result being that the burner, corrected to 26 cubic feet of 16-candle gas, gave the light of 144·9 standard sperm candles of six to the pound.

This is a remarkably good result. It shows that every cubic foot of gas was giving light equal to that from 5·5 candles; whereas, so far as I am informed, the highest amount of light developed by any burner of this class does not amount to more than 4·7 candles per cubic foot of gas.

If the results obtained with the Siemens burner be compared with the published results given by the most effective of the large burners, it will be seen that the former produces a considerably increased development of light from gas of a given value.

The mean pressure of the gas in the above experiments was 0·43 inch at the point of ignition.

T. W. Keates, F.I.C.,

Consulting Chemist to the Metropolitan Board of Works,
Superintending Gas Examiner to the Metropolis, &c., &c.

A PLEA FOR SUBORDINATE OFFICIALS.

Sir,—As Christmas is once more at hand, and it being the season when the salaries of officials of gas companies are revised, may I ask your interest *in favour of the subordinates, and their more adequate remuneration?* I use the words advisedly, for I believe in no other industry is so much expected and obtained at so low a scale of payment.

It is true that many chief officials of large companies are in receipt of handsome salaries; and it is equally true that directors are only too apt to generalize from the particular, and consider the appearance of two or three large amounts at the top of the salary-sheet as compensatory, by some occult means, for the swarm of little items below. But it is a case of "a pike among the minnows;" and I do assure you, Mr. Editor, on the part of the subordinate officials, that this reflected benevolence in no way helps us with the butcher and baker, or eases us in what, in the most of our cases, is a struggle to make both ends meet. Of course we cannot expect the governing bodies to see our case in the same clear light as we do; but there are many reasons why they might, with interest to themselves, favourably consider the question.

Take the case of an underpaid clerk or book-keeper, surrounded with opportunities of being dishonest. A naturally honest man reduced to that most miserable state of existence—genteel poverty—yields to temptation, escapes for a considerable period, perhaps; but is finally detected. Here we have a life ruined, and often very considerable loss on the part of his employers. Again: It is well known that an assistant engineer is to his chief as the first lieutenant is to the captain of a man-of-war. He—the assistant—is responsible to his chief for the economical administration of the affairs of the works, which in many cases is no slight matter, involving the control of several hundred men; and, as he generally has the taking on and discharging of hands, it will be seen what an influence he possesses over the expenditure when it is remembered that one man more than is necessary means a loss of at least £50 a year.

In no better case is the manager or engineer of a small or medium-sized works. The whole year round from morn till night—perhaps with the exception of the few days he gets to attend the meetings of the Association—he devotes the whole of his time and energy to the benefit of his employers, for often less than is paid to a mechanic. Surely responsibility should be of some appreciable value! It may be said that I am putting in a plea for dishonesty, and that this is taking the form of a threatening letter; but as such I in no way intend it, and do heartily and sincerely believe that my brother officials throughout the country, with few exceptions, fulfil their duties honestly and to the best of their abilities. I have simply stated what has happened, and, doubtless, will again happen; and, although an increased salary will not make an honest man of a rogue, yet remembering

"How oft the sight of means to do ill deeds,
Makes ill deeds done,"

temptations of many kinds have little power with those who can afford to be honest.

I must apologize for taking up so much of your space, and hope our respective boards and gas committees may wish us "A Merry Christmas" in the way we would most appreciate.

Dec. 17, 1880. One of Them.

DR. ADAMS'S GAS STOVE.

Sir,—We note, in your issue of the 7th inst., that Mr. Denny Lane states that his authority for quoting an alleged report of Mr. Bruce conjointly with Dr. Adams, on the efficiency of the latter's stove, was founded on the following statement published by us:—"As a means of comparing the results obtained from this, with those obtained from other stoves, we annex particulars of tests made by Dr. Adams and Mr. J. L. Bruce." We fail to see that there is anything in the quotation to lead Mr. Lane to infer that it was a *joint* report, or, indeed, a "report" at all. This error on Mr. Lane's part is emphasized by the fact that Dr. Adams and Mr. Bruce have already, in your columns, repudiated the alleged report.

The real point at issue, however, is: Are the claims, or rather the definite statements of Dr. Adams, given in his paper, "certainly exaggerated;" or can they be verified and corroborated by others? For our own part, and from a long series of experiments, we vouch for the accuracy of Dr. Adams's tests, that, with Glasgow gas, 51,300 units of heat were utilized per cubic foot of gas consumed. The result is not equally good with Birmingham gas, though the difference is not so great as to bring it *even nearly* within the limits which Mr. Lane insists upon.

As one of the "old makers," we fear we must plead guilty to having been "very much in the dark," if by this it is understood that we have been and still are unable to prophesy or practically anticipate all possible advances yet made, or to be made in the future. But we feel no more shame in acknowledging this past ignorance than all the "old makers" of street-lamps should feel if it were alleged that they had been "very much in the dark" because such splendid lanterns as those manufactured by Mr. Sugg, Messrs. Bray and Co., and Messrs. Edmundson and Co., have recently been introduced. Is Mr. Lane prepared to say that an absolute standard has been fixed, upon which it is impossible to improve? A reference to the history of gas lighting will, we think, show that this is not the case. For instance, the standard test burner described in the Metropolis Gas Act, 1860, would hardly now be considered the acme of perfection. If, then, the standard of light has been surpassed, why should not the standard of heat? The stove known as the "Imperial" gave, we believe, better thermal results than any other, until the introduction of Dr. Adams's stove; but we are free to confess that in comparison with the latter it is left far behind.

Dr. Adams, in his letter in your issue of the 7th inst., has gone very fully into several points of issue raised by Mr. Lane; but there is one point overlooked, to which we should like to call attention. We refer to Mr. Lane's remarks relative to the value of radiant heat developed in the stove. From his remarks it is clearly evident that Mr. Lane is not familiar with the construction of the stove, or he would see that it is specially designed to utilize this radiant heat. The mass of incandescent material placed centrally at the bottom of the stove, is surrounded by a portion of the walls of the base of the stove, and it is these walls that receive the rays of heat which warm them, and they, in their turn, impart the heat *by contact* to the air which is admitted into the stove, and with which the walls are freely bathed. It is an altogether mistaken notion on the part of Mr. Lane that this chamber, heated by radiant heat, is shut off from the external air. The external air flows through the hot-air chamber at the base of the stove as freely as the outer air flows into the entrance hall and passages of a dwelling-house when the outer door is opened. And if there is a powerful open fire in this entrance hall, warming the walls, &c., by *radiant* heat, then the

entering air is warmed by *contact* with them. This is precisely the case with the stove, and the value of this conversion of *convected* into *radiant* heat lies in the fact that by this means the heat is localized at an early stage, and immediately utilized. Under other circumstances, there is a mass of hot vapours which can only usefully impart their heat to a heating surface if that surface is of great extent, or if carried along a flue of an impracticable length, which is always unsightly.

We would suggest that Mr. Lane should test the stove, and let your readers know the results he arrives at, for without question it must be a subject of great interest to them that a matter so important as the upholding or upsetting of the standard thermal unit power of coal gas should be fully investigated. There cannot be a question of Mr. Denny Lane's competency to deal with the subject, but we venture to suggest that he has erred by adhering to the theoretical standard rather than testing the apparatus, and satisfying himself, by practice, whether or not that standard had been eclipsed.

Birmingham, Dec. 10, 1880. JOHN WRIGHT AND CO.

SIR,—In your issue of Dec. 7 I corrected certain erroneous statements made by Mr. Denny Lane; and I so discussed the practical issue raised by him, with regard to the amount of heat obtainable from coal gas, as to demonstrate that he was altogether ill-informed on the subject. Mr. Lane, in a further communication, in your JOURNAL of Dec. 14, leaves it to be gathered that in his reference to "the report of Dr. Adams and Mr. J. L. Bruce," he was in reality referring to some observations made by a third party in a contemporary periodical, and was therefore, as I indicated, altogether in a delusion regarding a "report," which existed only in his own imagination. Mr. Bruce has added his corroborative testimony to mine, and it is difficult to understand how, with ordinary prudence, any person could form, and so unguardedly act upon the conviction that led Mr. Lane astray. It further transpires that it is from the same commentary of a third party that Mr. Lane professed to give "Dr. Adams's own statement" in the very words of Dr. Adams; for, to make his allegations trustworthy, he gives a sentence in inverted commas. As he expresses no contrition for his offence, I again characterize his pretended quotation as a pure fabrication.

Mr. Lane's error as to the figures representing the specific heat of air, in which he was corrected by Mr. Bruce and myself, is, I admit, a very trivial matter, and I was only induced to refer to it because I found, in tracking Mr. Lane from one point to another, that he seemed to lack accuracy at every point he touched. But he is a man difficult to instruct, for he expressly declares he is not grateful for being corrected in his erroneous statements; that air can be "*burnt*;" and that Dr. Arnott had taught that doctrine. I have given him Dr. Arnott's own words—truthfully quoted—but he desires "better authorities."

Mr. Lane has become so confused in this discussion that he has committed the amusing blunder of confounding his own identity, and merging it into mine. In your JOURNAL of Nov. 23, he said 1 lb. of air at 62° = 13·156 cubic feet, and made his calculations accordingly. I corrected him in your issue of Dec. 7, and gave the figures 13·14. In his letter in your issue of Dec. 14 he complains that I impeach his accuracy, and refers me with triumphant precision to the very page of an authority where I will find—what do you think, curious reader?—a verification of *my* accuracy and a proof of Mr. Lane's *in*accuracy. So completely has he transposed our persons and our statements, that in telling me I will find 13·141 to be the correct figure, forgetting his first statement that it was 13·156, he innocently adds, "I did not think it necessary to go to the third place of decimals." In his first erroneous quotation it will be observed that he *does* go to the third place of decimals, and that in my correction it is I who have not gone to the third place of decimals. How is such a man to be contended with?

In nibbling over such little side issues, Mr. Lane drops all further reference to the main question—viz., the potential heating value of gas, which he at first assumed to be 700 units. So far and no farther. But he has evidently been pondering deeply over the question. He tells us he does not agree with Dr. Wallace's experiments and deductions for reasons—well, "for reasons," he says, "which I will at some other opportunity point out." Neither does he agree with Dr. Ure, at whom he points the finger of scorn; and meanwhile he details an experiment of his own devising, performed on himself in an apartment of a given size, where, at the moment he was writing, he tells us he had been "sitting for five hours" with three gaslights burning. From this data it is to be inferred that it was an after-dinner sitting, although he guards against any erroneous inference by assuring us he was, notwithstanding the conditions described, "*mens sana in corpore sano*." These being the conditions, he lays down the proposition: "As Dr. Ure says that 1 cubic foot of gas heats such an apartment 20°, 60 cubic feet must have heated it 1200°." "Strange to say," he adds, "the lead pipes have not melted," &c., &c., and straightway Mr. Denny Lane bursts into the fag end of a convivial song. I freely admit my inability to contend further with Mr. Denny Lane; to serious inquirers on the points raised I make reference to my communication in your columns of Dec. 7.

Glasgow, Dec. 17, 1880. JAMES ADAMS, M.D.

DR. SIEMENS'S GAS FIRE.

SIR,—Having since the publication of the article on, and illustration of Dr. Siemens's gas coke fire, had one made and fitted to an ordinary fire-grate, it gives me much pleasure to bear testimony to its efficiency. If followed up and made more widely known by gas managers in their several localities, it should prove a source of profit both in the use of gas for lighting fires, and the more extended use of coke for domestic purposes.

To those who have not yet tested the arrangement, I would say, "Try it."

After the coke is once fairly in a state of combustion the gas may be turned out or kept burning very low, at the pleasure of the user; and as the coke gradually burns away, more can be added in the usual mode.

Southampton, Dec. 18, 1880. S. W. DURKIN.

[A modification of Dr. Siemens's original arrangement is described in our "Notes" column to-day.—ED. J. G. L.]

Legal Intelligence.

NEWCASTLE COUNTY COURT.—WEDNESDAY, DEC. 15.

(*Before Mr.* BRADSHAW, *Judge.*)

ASKWITH *v.* THE NEWCASTLE AND GATESHEAD WATER COMPANY.

In this case Mr. H. C. Askwith, 3, Ridley Place, Newcastle-on-Tyne, sued the Newcastle and Gateshead Water Company to recover 3s. that had been "illegally extorted" from him by the Company.

The *Plaintiff* stated that he commenced to take water from the Company in July last, and on Oct. 15, while he was absent from Newcastle, a demand note was left at his place, asking for payment of the amount due up to Nov. 1. On Oct. 22 the water was cut off, and on Nov. 26 he applied to have it again supplied to his premises, but the Company declined to do so until he paid the water-rate due up to February next year. On Nov. 26 he paid 8s. 9d. for the water supplied from July to Nov. 1, and he also paid, under protest, 7s. 6d. for the water-rate for the full quarter ending February next. He maintained that, as the water was cut off on Oct. 22, and was not turned on again until Nov. 26, the Company were not entitled to be paid for that time, and he brought this action to recover the 3s. paid for the 36 days, and which he said was "illegally extorted" from him. He also stated that he had read in the Company's Act that they could not charge the water-rate in advance for water supplied to business premises, unless the occupier signed an agreement to pay in advance. His premises were solely used for business purposes, and he had never agreed to pay in advance.

Mr. G. ARMSTRONG, who appeared on behalf of the Company, stated that one of the conditions of their Acts of Parliament was that the contract between a person taking water and the Company was an annual contract, to continue until it was determined by notice. The plaintiff commenced to take water in July, and had never given any notice to discontinue the contract; and the water-rate was to be paid quarterly in advance on the first day of February, May, August, and November. If a person entered during a quarter, the Company were by law entitled to charge for the full quarter, but the practice was to charge only from the time of entry. The plaintiff had not paid the rate, and the demand note stated that the rate had been twice called for, and that unless paid within three days the water would be cut off. On Oct. 22 it was cut off. The Company had exercised their right to stop the supply, and under the provisions of their Acts the plaintiff must pay.

The JUDGE said the demand note left at plaintiff's premises on Oct. 15 stated that the water would be cut off if the rate was not paid; and, the money not being paid, the Company had a right to cut off the water. He gave judgment for the defendants.

The *Plaintiff* asked to be allowed to appeal against this decision, but the Judge declined to grant leave.

Miscellaneous News.

THE SHEPPY GAS-WORKS VALUATION.

SURVEYORS INSTITUTE, WESTMINSTER.—MONDAY, DEC. 13.

(*Before Mr.* J. CLUTTON, *Arbitrator.*)

SHEPPY GAS COMPANY, APPELLANTS, *v.* THE GUARDIANS OF THE SHEPPY UNION AND THE CHURCHWARDENS AND OVERSEERS OF MINSTER, RESPONDENTS.

This was a reference from the Court of Quarter Sessions for East Kent, to determine at what amount the Sheppy Gas Company should be assessed to the Sheppy Board of Guardians, acting as the Assessment Committee, for their works situated at Sheerness. The case as heard before the Justices was reported in the JOURNAL for Oct. 26 (see *ante*, p. 650).

Mr. W. H. MICHAEL, Q.C., and Mr. F. O. CRUMP again appeared for the Appellants; Mr. E. J. CASTLE for the Respondents.

Mr. MICHAEL, in opening the case, said by the order of reference the Arbitrator was to report as to the assessable value of the Gas Company's property, leaving the question of costs to be subsequently decided by the Court of Quarter Sessions. The value of the assessment in gross was £1898, and the rateable value £1496, the previous rateable value being £622 10s. The Sheppy Gas Company was first established as a limited liability company in 1857, and commenced to supply gas in 1859. In 1871 they obtained for the first time a special Act, in which was incorporated the Gas-Works Clauses Act, 1847. The capital authorized by the Act was first £4000, upon which 4 per cent. dividend might be paid, and there was power to raise a further £21,000, bearing 10 per cent. dividend. The absolute amount of capital raised at the time was the £4000 in "A" shares, and £19,743 called "B" shares, the total authorized dividend being £2134 as the maximum. Taking the law as it stood with regard to the hypothetical tenant, he thought there would be no difficulty as to what were really the questions to be decided. They were, first, to take the amount of the gross revenue received for gas, residual products, and meter-rents, and from this to deduct the cost of materials incident to the production of gas, and by this means they would arrive at the net profit which the Company could earn. But when they came to consider the question as to what the hypothetical tenant would give in the way of rent, they must go back to the decided cases, and then consider what were the proper deductions to be made. The first point to be discussed would be what was the amount of working capital which would be required to carry on the works. The Courts had clearly laid down the principle that it was left to the Quarter Sessions, and therefore to the Arbitrator, to determine what was the proper amount of capital which such an imaginary tenant would require to have in order to carry on the works. The principle he should lay down was very easy of comprehension. In the carrying on of the business of a gas company, supposing it to be *ab initio*, as it would be if the imaginary tenant came into possession, he would have to carry on the concern for four or five months before he would receive any return whatever for his invested money. The Arbitrator would, therefore, have to determine what was the proper amount of capital which should be allowed for carrying on these works; next he must determine what were proper allowances to be made. There was, first, 5 per cent. upon the capital by way of interest; secondly, 10 per cent. upon the working capital by way of profit; and, thirdly, 2½ per cent. by way of provision for risks and casualties; making a total of 17½ per cent. It might seem at first to be anomalous that where, by the Gas-Works Clauses Act, 10 per cent. was the limit of profits, 17½ per cent. should be allowed of what might practically be said to be profits, although they were not really so; but it must be remembered that the 10 per cent. was a sum carried over the whole capital of the Company, which had been expended, and must be continually expended to keep up the undertaking as a going concern, and to replace such parts as of necessity must become worn out. Therefore, it was not 17½ cent. calculated over the capital, but on the comparatively small amount of it which was represented as simply the working capital, to enable the imaginary tenant to carry on the concern. There would be two questions to decide on this point—first, what was the amount of capital which should be in the possession of an imaginary tenant to enable him to carry on the concern; secondly, what should be the amount deducted from the total amount as net

revenue. Having found this, the Arbitrator must decide what was the amount which should be set aside from year to year by the imaginary tenant in the way of statutory deductions, to replace the works so as to keep them in the condition to earn, from time to time, an amount of profit which was to recoup him for the expenditure of his time and capital. First, he must insure, or have an insurance-fund; secondly, he was entitled to have such a sum as would keep the works in a proper condition to earn the amount of profit which was to recoup him. It would be necessary for the Arbitrator, when looking at the photographs and considering the information which would be conveyed to him, to remember that the works were not in the very best state of repair, and required an immediate expenditure upon them of some considerable capital. When he (Mr. Michael) said this, he did not mean capital which could be taken out of the Company. It was a well-established fact in the conduct of gas companies, that after the statutory dividend had been earned, the Directors became *quasi* trustees for the public, and any profits which might be earned beyond those required for dividends were to go back to the public in the way of a reduction in the price of gas, and any cost of replacement of works of a structural character could not be met by raising new capital, but must come out of revenue. The Arbitrator must find, under the head of statutory deductions, what was the proper amount to lay aside year by year in order to keep the works in such a proper going condition as to earn the profit. The peculiarity of these works was that they were built on an alluvial soil of a very shifting character, and they were at the present time in a bad state of non-repair, the soil being also of a character extremely unfavourable to the duration of the pipes placed in it. Evidence would be given as to the average life of such works, and as to what amount, spread over a certain period of years, would be sufficient, on the lapse of their life, to replace them. Having made these deductions, they would arrive at a net sum which he said was the net rateable value, and should replace the sum of £1400 fixed by the Assessment Committee. He did not gather that the accuracy of the Company's accounts was disputed; they would show the main features —namely, the receipts in the way of revenue and the expenses. The amount of capital required must be taken from skilled witnesses. The amount of percentage was given in the case of *Reg. v. Inhabitants of Lee* —namely, 17½ per cent., an amount which had been subsequently allowed in every case about which he knew anything.

Mr. CASTLE, on behalf of the Respondents, said he would admit the accounts of the Company.

Mr. *Alpheus William Marks*, the Secretary of the Company, produced a copy of the accounts.

Cross-examined by Mr. CASTLE, witness said that the trade account showed the complete four quarters rental, irrespective of the question as to whether the money had been collected or not in the year, whereas the statement of income and expenditure simply showed the cash received on the account during that period. The trade account for 1879 showed a gas-rental of £7154, from which £431 was allowed for discount. Besides this there was a deduction of £50 for bad debts, of which perhaps £40 was due to gas-rental. The net gas-rental was £6683. The total cost for coal was £3186 17s. 11d., and deducting the amount received for residuals, £1440 15s. 9d., and £10 for bad debts, the net charge for coals was £1736 2s. 2d.

Mr. *E. Ryde*, examined by Mr. MICHAEL.

I am a Land Surveyor, and a Member of the Institute of Surveyors. I have made a valuation of this property for the purpose of the rate. The basis of my calculation was the trade account of the Company for 1879, as representing their work for the period over which the account ran. I took the absolute working of the concern as the basis upon which I assumed what an imaginary tenant would give for it. The gross receipts were £7375, including for meter-rents, fitting, and stove-hire, £220. I deducted £50 for bad debts, and £432 for discount, leaving £6893. The cost of coal and lime was £3223, and deducting from this £1469 received for residual products, the net cost was £1754. Adding to that £873 for wages, £477 for salaries and commission, £61 for office and incidental expenses, £30 for law charges, £100 for Directors fees, £15 for Auditors, and £207 for rates and taxes, the total working expenses came to £3517, which, subtracted from £6893, left a net receipt of £3376. Having found this, I proceeded to determine what would be the amount of capital a tenant would require to work the concern. I first assumed that a tenant, in order to be in circumstances to enable him to carry on these works, must have capital enough to pay five months working expenses. He must go on for three months before he could make any charge for the gas supplied, and it would take him another two months to get any appreciable amount of money in. I estimated one year's expenditure at £5234, and taking 5-12ths of this gave £2108 for the five months. I took 870 meters at £2 each, making £1740, the fact being that there were 970; £530 for coals, because the tenant ought to have at least two months stock in hand to meet contingencies; £250 for stores; and £300 for cash at bankers; making altogether £5300. This was the amount of capital which would be absolutely required by the imaginary tenant to carry on the undertaking, and it would be reasonable even to extend it by putting in a quarter's rent, for he would have had to pay it. I took 5 per cent. for interest, 10 per cent. for trade profit, and 2½ per cent. for risks and casualties; making £927, which, deducted from £3376, left £2449 as the gross estimated rental of the premises. It is obvious, from the appearance of the works, that they have not been kept in a complete state of repair, and therefore any reference in the accounts to what had been spent on repairs might not be any guide as to what a tenant, who was bound by a covenant to maintain the works, might have to lay out; I have therefore looked to see what the expenditure has been on other works. I put the repairs at £1015, and in arriving at this sum I used the experience I have gained in carrying on my business as a Surveyor. The property is in a very bad condition; it was probably badly built upon a bad foundation, and some of it is in the last stage of dilapidation. I should consider that the works require to be rebuilt at once. Assuming the cost of the works to be £20,000, and giving them 20 years life, the Company would require to provide a sinking-fund of £660 a year. Adding £20 for insurance, the three sums give £1695 to be deducted from the £2449, leaving £754, which is the net rateable value, and I do not believe any tenant would take the works at this rent.

Cross-examined by Mr. CASTLE: I have had a great deal to do with gas-works, but cannot call to mind an instance in which I have let them. I have been concerned in the sale of many—for instance, the Dundee Gas-Works—but have not built works.

Mr. CASTLE said he was instructed to admit the working expenses, £3517, and £3376 as the net receipts. The real question between the parties was what should be allowed for the occupier's share and for statutable deductions.

Cross-examination continued: The 17½ per cent. for the occupier's share is a question of fact which the law has recognized. The amount for salaries would have to be found weekly, fortnightly, or monthly. I have not allowed anything for the sale of residuals, because I could not depend upon selling them in the five months and getting the money. When the hypothetical tenant sells his residuals, he often has to wait for the money. He would not be paid for them faster than he would be paid for his gas. He would often accumulate a stock of coke. The £350 is an estimated amount for retorts. I did not look into the accounts for the previous year; I looked at the retorts and asked questions about them. The capital put into the business to work it must always remain there. The business could not be carried on by a tenant who had to pay rent unless he had command of £5300. My £300 is a small amount to be kept at the bank.

Mr. CASTLE: You are allowing the tenant 17½ per cent. not in the case of a railway, where a man turns all the money into rolling stock, but simply because he wants some money in advance to pay for these different items which will come back to him as money in the way of business?

Witness: First as to the 5 per cent., the tenant gets no profit at all. As to the 2½ per cent. the tenant never gets it—it is a contingency-fund to secure him the 5 per cent. and 10 per cent. All the tenant gets here is 10 per cent.; that is the profit he makes out of the concern.

Cross-examination continued: The sum put down for the meters is too small; it will be proved to be a larger figure. I have not seen the meters, but the £2 each is the best result of the combined wisdom of three or four gentlemen, who thought the meters were worth this amount on an average. The 2½ per cent. the tenant is supposed never to take out of the concern. If the receipts do not come up to the mark, or the expenses exceed the amount, this is the only sum out of which he can get an indemnity. As to maintenance, the amount expended during the last few years is no guide. The money spent has not been sufficient to enable the works to command the rent, though they do the work after a fashion. For some years the works have done their utmost duty in every sense of the term, for they would not do much more. They will go on till they break down. They are not safe now. I say the Company ought to begin directly to repair and renew them. I cannot tell when the works will fall down—whether next week or next year. I do not put it that they are in immediate danger of coming down, but they are in a very bad state. The yearly manufacture is 34,871,000 feet of gas, and I put the repairs of premises at 7d. per 1000, which works out to £1015. It cost the London Gas Company 7½d., and the Phœnix 6¾d., for the year 1879. I assume £20,000 as the value of the works to build, and their life has been practically proved to be 20 years. This represents everything—gas-works and appurtenances; £7000 for buildings, £7000 for plant, and £6000 for mains. They all, more or less, require renewing. The Company will have to renew everything within the next two years, and ought to begin at once. A larger sum than the average must be expended upon the retorts this year, for they have got into such a condition that the average of £350 a year for the next year or two will not keep them going. Something like £500 a year is wanted in ordinary gas-works. I should put the buildings and mains at 40 years life, the gasholder at 25 years, and the valves and so on at 15 years. I should put the retorts at about two years life; they are burnt out so quickly. A piece of main will be produced to show the state the pipes are in. If the mains have been renewed from time to time, this sample will show that they have not lasted 20 years. At Weymouth a gas engineer attributed ten years life to some of his pipes, where they were close to sea water. There are many pipes and things about gas-works that are put down and taken up again before they are really worn out, because they have become totally unfit for the purpose intended. The ordinary average life of a gas-main is not more than 40 years. If some of the mains are not worn out, they will probably have to be taken up, because they are quite unsuited for what is now required, and they would not be worth anything to put down again. The period of 20 years is taken at 4 per cent., and £660 a year would give £20,000 in 20 years. Though 40 years is the average life of gas-works, I take 20 years in this case, because the buildings are badly built, and on a bad foundation.

Re-examined by Mr. MICHAEL: The Company commenced to supply gas in 1859, and from that time to this day have been extending their works and expending capital. The works require to be renewed *in toto*, with the exception of the large gasholder, which has been erected within the last five or six years. If the Company had put by the sum of £660 a year from the commencement, they would now have a sufficient sum to replace the works. This is the whole scheme and basis of my calculation.

Mr. MICHAEL: That being the scheme, could the Company do as my friend suggested, go to Parliament and get additional powers to expend £20,000 of fresh capital, and charge the ratepayers with the money so expended?

Witness: I suppose they would have to catch one gentleman—Lord Redesdale—asleep.

Mr. *Alfred Penny*, examined by Mr. MICHAEL.

I carry on business in Westminster, and for upwards of 30 years have had very large practical experience in connection with gas-works and gas undertakings. I am also a lessee of gas-works. I have prepared an estimate of the amount at which, in my opinion, these works should be rated. In preparing the estimate, I took most of the items at the same figures as Mr. Ryde, and made the total receipts of the Company £8276 15s. I took the quantity of gas sold, and charged upon it a certain price for ordinary repairs and maintenance of works, and it brought out the total at £870. I took 6d. per 1000 feet as sufficient to pay for ordinary repairs and maintenance, supposing the works to have been built properly to begin with, and on such a foundation that they would stand. This is something in excess of the sum the Company have charged. The absolute state of things with respect to the works is this, that the mainstay of the whole concern —namely, the retort-house—is in a condition of absolute danger. It is about 26 inches out of the upright, and the retorts, instead of standing level, have fallen back to such an extent that the setters could not get into the arches the number of retorts they were originally intended for. I should advise that immediate steps be taken to replace the works. The coal-store adjoining the retort-house is simply held up by a number of iron stays, and the whole thing is most dangerous. This has resulted, in the first place, from precautions not having been taken to secure a proper foundation, and next from the absolute badness of the foundation itself. It is quite exceptional in its way. It is an alluvial soil, and if the utmost precaution had been taken in the first instance, I do not think the Manager would have kept the place right. But it is quite clear that ordinary precautions in respect to such a site were not taken, and therefore the appearances exist which I have described. The retort-house might fall in any day, and the consequence would be that the Company would break all their obligations to supply the town with gas, and the public would suffer. I have seen some of the pipes and mains. The peculiar nature of the soil has turned them so soft that they can be gouged out with a chisel, and I have no doubt, taking them all through, they are in a bad condition.

TUESDAY, DEC. 14.

Mr. *Penny* recalled, and further examined by Mr. MICHAEL.

The tenant's capital that would be required for carrying on the undertaking would be made up of three things. The whole expenditure for the year being £5907, I take half of that amount, or six months expenditure, £2953. To this I add for stores, cash at the bankers, and so on, £800. Then I take the value of 977 meters at £2 each, £1954. These amounts added together make £5707—say £5700 in round numbers. The tenant could not do with less capital than this, and it is evident, from the accounts

of the Company, that they are employing this amount of capital. It appears, from the statement of income and expenditure in the Company's annual accounts up to Dec. 31, that the amount due for gas at that time was £2300; arrears, £139; due for coke, tar, &c., £295—in all, £2734. The stock account amounted to £815, and the cash at bankers to £267, making a grand total of £3826. Then there is the retort suspense account—money spent on retorts which it was not thought advisable to bring into the current year. If this is added it will make £4259. Then the probability is that a quarter's rent would have to be paid, and this would be £150 a year more. I think, therefore, I have amply justified my claim of £5707 as tenant's capital. With regard to the meters, I worked out the cost according to the list at £1583, and to this will have to be added the cost of fixing and the material used in fixing. I have put down five shillings each for fixing the meters, which is a low average, and it allows nothing for Government stamping and so on. According to my experience as a lessee of gas-works, it would be impossible to put a lower figure. I have checked my estimate by the actual accounts of the Company, and the amount I have asked is really less than would be absolutely necessary. I adopt Mr. Ryde's principle of 5 per cent. for interest on capital, 10 per cent. for profits, and 2½ per cent. for risks and casualties. With regard to the sum I have put down to place the works in an efficient condition, I admit that it is an abnormal sum, and beyond anything I have ever given before; but the state of the case is such that it is absolutely necessary that the sum I have named should be set aside in order to put the works in a condition which a tenant would require them to be in before he would take them. The works were commenced on a limited scale 20 years ago. The retort-house was a very small one, only 28 feet wide, which was perhaps sufficient when the Company had short retorts; but the exigencies of the work have compelled the Manager to put in very much longer ones. The Company commenced with retorts 7 ft. 6 in. long, and those they now have are 10 feet in length. They began with beds of three retorts, and now they have beds of five, seven, and so on. The Company appear never to have recognized the fact that the condition of things which was sufficient when they started was totally insufficient and improper as the consumption of gas went on doubling, trebling, and quadrupling. The great weight of the new beds of the retorts has completely pressed down the ground, so that there is a difference of 2 feet and some inches in the level of a wall—that is, the end of the wall of the retort-house has sunk that depth. This is a very dangerous state of things, and I understand the mischief still continues. I do not know of another case in which such a state of things as this exists. Any day the town may suddenly be put in darkness. What I think ought to be done under the circumstances is this: There is shown in the corner of the plan a small dwelling-house, which, in my judgment, ought to be pulled down, and as the gas-works must be carried on, and a retort-house is a necessity, the site of this house is the only place where it can be put. The building from this point must be cleared away, and a new retort-house and coal-store commenced on this side. There is no other way out of the difficulty. There are two gasholders that are worn out and of very little use. Neither of them will go down into its tank. One gives 2 inches pressure, and the other 2·1 inches. They are totally useless, except for supplying the public lamps after one o'clock in the morning. One holder ought to be cleared away altogether, so as to give a little more yard space. There is no room to stack the coke, or to move about. The gasholder ought to be taken out, and the tank covered in and made a tar and liquor tank. Even if one holder were cleared away it would be a good thing; but if it is not taken down it must be renewed. The other holder has been up about 15 years, but it is in good condition; at all events, it is the Company's mainstay—they have nothing else worth considering for the storeage of their gas. These alterations would involve the building of a new house for the Manager on some ground the Company have across the road. I have been imagining the case of a tenant, and I say I would not take the works unless they were put in such a condition that I could earn and pay the rent. If the Company had known all that I know about the matter, they would long ago have put aside money for renewals. The sum I have named is absolutely necessary for the proper conduct of the works. The Company are under certain parliamentary obligations; but they have never had proper advice, or they would not have allowed the works to get into their present condition. It is absurd to think of their selling 40 million feet of gas from such works. The time must come for renewals of plant, not necessarily because the things are worn out, but because they have to be replaced by larger ones. Where a larger thing is substituted for a smaller one, the surplus is charged to capital, and the rest to revenue. The capital of the Company is not represented by the value of their plant and works, and it will be a proper thing for them to spend out of revenue that which they have neglected to spend up to the present time. They have been paying as dividend money that ought to have been employed in keeping the works in a proper condition. They have failed to recognize the fact that the site of their works is an abnormal one, requiring them to put away such a sum as would enable them to pay for the short life of their plant. I have not examined the mains, but I am informed by the Manager that they are in a very perishable condition. In such soils as that of the Company's district, mains soon begin to soften and perish, and when they are taken up they are nearly worthless; in other soils I have known mains taken up in a good condition after lying in the ground for 50 years. A great deal of the ground is made of cinder ashes brought from the Dockyard, and this material tends to destroy iron very quickly, owing to the chemical mixture exuding from the ashes. Insurance of plant is a statutable deduction. This I have put down at 15s. per cent., but perhaps that is more than it ought to be. There was a time when gas plant was insured at 25s., 21s., or 15s.; but I have heard that there are some Insurance Companies who take this kind of business at 10s., and even as low as 7s. 6d. per cent.. Some gas companies insure themselves.

Mr. Michael: You have taken for repairs 6d. per 1000 feet of gas?

Witness: That is for ordinary repairs and maintenance. It is only an average sum; it is not a criterion of what should be spent in any one year. This year 8d. or 9d. might be required, and only 3d. or 4d. next year.

Cross-examined by Mr. Castle: I have had experience as a lessee of gas-works, but with one exception have given up that sort of thing. I have leased the gas-works at Portsmouth and at Whitehaven, also some foreign works—those at Oporto, for instance. I have never heard of a tenant from year to year in the case of gas-works. I have put down the sum of £4259 as representing money that would be emitted by a company or a tenant, that is without reckoning the meters. I have added a quarter's rent—£150—and if I had to find meters I should require £1954 more.

Mr. Castle: Did you ever know a case in which a tenant took over the meters?

Witness: Certainly; it was done at Worthing, where the works were leased for seven years to a Mr. Brothers, who, I presume, took over the meters. Those at any rate were the terms on which the tenders were made. It is not, however, the general custom for lessees of gas-works to pay for the meters. At Whitehaven I had to provide all the new meters during the last 14 years, and now half the value of them belongs to me. It is not the custom for tenants of houses to provide meters; it is, however, a matter of agreement. If a company insists upon a tenant providing his meter, there is, of course, so much less rent to pay. There are very few gas-works held on lease; it is quite an exceptional thing. The lessee of gas-works is obliged to do all that the company are compelled to do by law—that is, to supply everybody who applies for gas—and therefore he is obliged to find meters for the purpose.

You have given a total expenditure of £5907, and you say that half this amount is what the tenant ought to have in order to go into the works. Now, according to your experience, is not that absurd?—I do not see the absurdity of it.

The tenant turns over his money four times in the year, and yet you say he must find £2953 as capital on going into the works?—The accounts amply justify my statement. If I do not provide the money to-day, I must provide it to-morrow. The figures really amount to £4400, but I have only asked for £3753—that is, £2953 and £800.

You assume that the Company's accounts have been correctly kept, and you adopt the figures in one case, but you drop them in the other?—I assume that when a company publishes a statement that they owe so much, the figures are correct, and yet the company may not be able to understand the working of a concern like this. It is clear to any one who understands figures that some time or other the lessee of these works must have emitted a sum amounting to £4000. This includes some profit, but then I am only asking for £3753. If I took the concern, I should be in the same position as the Company are in; I should be owing so much for gas, and I should require to make the same expenditure.

How do you justify your estimate of six months expenses when the money will be coming in after the first quarter?—What I say is that I shall want the £3750 to work the concern as I go along; I may not want it all at once. Perhaps the tenant begins at Midsummer, which is a light period, and the money is collected for the quarter ending Sept. 30, and is received perhaps before the end of November, leaving some arrears. But during that time the tenant must go on making a large expenditure day by day for coals and so on, for which perhaps the money will not be collected until February. This is how the money is eaten into in providing all the requirements for the winter quarter. To work the concern properly I should want the whole sum I have given.

Cross-examination continued: Supposing the tenant commenced with a heavy quarter, then he would want more, for he would have two winter quarters to provide for. It is impossible to start gas-works, say at Christmas, without a good stock of coal. When I went into the Portsmouth Gas-Works, I paid £3000 in taking over the stock. The gas-rental in that case was about £12,000. I had to carry on the works for four months before I was entitled to a shilling. The amount received for residual products is very small, and it does not come in for some months. At Whitehaven we carbonized between 2000 and 3000 tons of coal, and the ready money we received did not amount to £10. With regard to the profit of 17½ per cent., I think if a man put £5000 into a business he would be surprised if he could not get out of it £600 or £700 a year. As to Directors fees and expenses of that sort, I see no objection to their being charged. The Manager receives £200. The tenant would not live upon the works, and so there must be some one to superintend. I could not carry on such works as these with a Manager at £200 a year, I should be ashamed of myself if I did; for a man having all this responsibility to receive £200 a year is simply abominable. He has to make 50 million feet of gas per annum, and is racked to death by anxiety about the works. The money put down for supervision is too little instead of too much. The actual expenditure put down in the Company's accounts in any particular year does not in every respect represent the sum that should be properly spent.

The Arbitrator: You say that the state of the property shows that the Company have not properly kept up the works?

Witness: Yes; and a large sum is now absolutely required to be spent upon them. This is partly due to the sinking of the coal-store.

Mr. Castle: If you claim a renewal-fund, it is based on the assumption that during the life of the buildings the sum of £660 a year has been put by?

Witness: No; if the Company had put by that sum, the rateable value would be there now. My estimate was £600. I say that £5000 would require to be spent at once to put the works into a condition to earn rent. Then, having regard to the abnormal condition of the ground, I am not certain, after I have used all the skill that I possess, that the works may not be in a certain time in a similar condition again; that is why I put their life at 20 instead of 40 years.

But £5000 would be realized if you had laid by about £160 a year for 20 years. How, then, do you justify £660?—It has not been laid by; there is no fund applicable to it. You may have had the benefit, for what I know, of the extra rateable value all this time, and you may have had the benefit of the Company not having brought the amount into their debit account. As soon as I have spent the £5000 in one place, I may go on spending £5000 somewhere else, and probably I shall want to do it. Looking at the whole value of the structure as if it was new, I find it comes to about £20,000. According to my judgment the life of these works will only be 20 years.

And you say now, after an existence of 20 years, the amount required is £5000?—On this particular place; but I think, having regard to the abnormal condition of the site, in ten years I shall have to spend £5000 over again.

Then do you mean to say that if the tenant, instead of expending £130 or £140 in repairs, expends the extravagant sum of £800 during the next 20 years, at the end of that period £20,000 will be wanted?—Yes, it is possible.

Cross-examination continued: There are 61 retorts; about 50 are lighted in the winter. As to the £5000 required to be spent, there would be for pulling down and rebuilding the retort-houses, and re-erecting 60 retorts (using the old materials as far as practicable) at £40 each retort, £2400; pulling down and rebuilding store to contain 1000 tons of coal (using the old materials), at 14s. per ton capacity, £700; reinstating two 50-feet gasholders, £1000; rebuilding Manager's house, £350. The governor-house requires to be rebuilt, and the apparatus requires setting up generally, and I estimate the cost of this at £600 or £700. These items added together will make a little over £5000. I say that during the next 20 years there will, in my judgment, be a necessity for spending £20,000 upon the works, and the mains and services will have to be replaced by additional ones. During the last 20 years the business of the Company has been growing year by year. The works are now making nearly 50 million cubic feet of gas annually, and the business is growing. The amount spent on repairs and maintenance by the London Companies is 5·65d. per 1000 cubic feet.

Re-examined by Mr. Michael: The Company began with a very small supply; hence the works are very insufficient for the present demand. Some portions of them are not 20 years old; the different parts have varying ages. If the works had been properly managed, they would require no such sum as I have now mentioned. If a sum of £650 a year had been spent upon them, they would have been kept in a state of efficiency. Although the quarter's rent accrues at the end of three months, a considerable period is occupied in taking the state of the

meters, making out the accounts, and collecting, and during this period money has to be expended. I consider the sum I have named as rather under than over the amount that would be required.

Mr. *R. P. Spice*, examined by Mr. MICHAEL.

I have had experience in all matters connected with gas-works for 30 years. I have seen the works of the Sheppy Gas Company, and they are in a state of extraordinary dilapidation, calling for an immediate expenditure of money. I agree substantially with the calculations of Mr. Penny. The sums actually spent by the Company for repairs and maintenance have not been sufficient; the present state of the works is evidence of that fact. The ordinary cost of repairs and maintenance throughout the country is about 6d. per 1000 cubic feet; in London it is 5d. and a decimal. I take one-half of the annual expenditure as the amount of capital required to undertake the works, Like Mr. Penny, I have been a lessee of gas-works, and I have not taken over the meters. I should not, however, advise a company to let their works without requiring the lessee to take the meters. About £5000 would require to be spent on the works at once, and it will require an expenditure of £600 a year for several years to come to put them in a proper condition. This is in addition to the ordinary maintenance expenses. I have here a portion of a pipe [produced] taken up from Hope Street, Sheerness, and you see the state it is in. Its age is under seven years. In such soil the mains are rapidly destroyed; and this, of course, greatly increases the expense of repairs and maintenance. Mains generally represent one-third of the whole capital of a gas company.

Cross-examined by Mr. CASTLE: I have never found capital for meters; I have had to take them as they were, under an inventory, and have had to find new ones for the new business and maintain the old ones. At the end of the term the new ones were paid for by the Company. The chances are that in ten years nine out of ten of the meters will have been paid for by the tenants, the old ones having been worn out. The life of a meter is only 10 or 12 years. The expenditure for repairs does not always depend upon the amount of gas made; it depends upon various surrounding circumstances. In a small concern the cost per 1000 feet will be more than in a large one. The amount varies in the London Companies from 7·66d. in the The Gaslight and Coke Company to 3·62d. in the South Metropolitan Company; and the estimate is not misleading if you take the average.

Mr. CASTLE then addressed the Arbitrator on behalf of the parish. He said Mr. Ryde had taken £6893 as the receipts for gas and other rentals, and the Respondents adopted this figure. He had taken £3517 for the expenses that the tenant would have to incur; this included a sum of £207, which he (Mr. Castle) proposed to take out and deal with later on, leaving, therefore, a sum of £3310 for working expenses. There had been a good deal of discrepancy between the figures adopted by the Company and those given by the witnesses. Sometimes the Company had been taken to be the tenant. The law said nothing about a "hypothetical" tenant; it said *a* tenant, and this tenant might be the Company, just as one person might be both landlord and tenant. The works had to be rated as being occupied by a company, and not by an imaginary person who came in and wished to make all sorts of extraordinary changes which a company would never think of making. Mr. Penny and Mr. Spice had not adopted Mr. Ryde's figures, for they had not allowed for the residual products.

Mr. MICHAEL remarked that they had allowed for them, but the account was made out in a different way.

Mr. CASTLE said Mr. Spice and Mr. Penny had charged a gross amount of £3186 for coals, and had not taken off the residuals as Mr. Ryde had done. Mr. Ryde had followed the proper course of giving a total of £3517 as tenant's expenses, instead of £5908. It was true that the amount for residuals was shifted from expenses to receipts; but Mr. Spice and Mr. Penny claimed 17½ per cent. upon the money which had not been deducted from the expenses. They had given £870 for repairs, but this was inadmissible, since in a yearly tenancy—and this was what the Act contemplated—repairs were not paid for by the tenant. These corrections would bring the figures of Mr. Spice and Mr. Penny down to Mr. Ryde's estimate of £3517. The real sum to be divided between the landlord, the tenant, and the parish, which was the real division in all such cases, was £3583, and the question was what the proportions should be. Mr. Ryde had put down the occupier's share as £927; the Respondents had put it down as £455. Mr. Ryde took £5234 as the tenant's expenses in the year, which differed from the amount previously given, and he justified it by adding the residual products—in fact, he did not take them off. He drew a distinction between the tenant's expenses, of which he took five-twelfths, and the working expenses. The Respondents figure was £3310, and the proportion 4½ months, or three-eighths, which amounted to £1350. They did not allow anything for meters. If a tenant with a long lease did not find capital for meters, *à fortiori* a yearly tenant would not. They would be simply valued to him. The Appellants adopted Mr. Ryde's sum—£530—for two months stock of coal; for tools and stores they allowed £300 instead of £200; and cash at the bankers, £300. The total was £2580 instead of £5300. They allowed 17½ per cent. upon the tenant's capital, it being a common error of surveyors that this amount should be allowed, although there was no justification for it. This percentage gave £455 as opposed to Mr. Ryde's figures. Deducting the £455 from £3583, there was left a balance of £3128. The amount to be set aside for repairs and renewals together was £665, instead of Mr. Ryde's extravagant estimate of £1695. As to the £5000 said to be required as a present expenditure, because there was a sinking of a wall for a couple of feet, this suggestion was absolutely without foundation. According to the report of the Directors of the Company, the premises had been kept in a proper state of repair; but, even if the wall had sunk, a few hundred pounds would suffice for the necessary repairs. The Appellants, however, talked about £660 for a renewal-fund, and £20,000 to be expended in 20 years time. The Arbitrator had to consider the tenant actually in possession, and not what a new incoming tenant might possibly want. The total rateable value of the works, according to the contention of the Respondents, was £1932.

Mr. *Henry J. Castle*, examined by Mr. CASTLE.

I have made an estimate of the value of the Sheppy Gas Company's works for this case. I have adopted some of Mr. Ryde's figures, though I may differ from him to a small extent, thus leaving only one or two points for the consideration of the Arbitrator. I take the figure of £3583, but I leave out the £207 for rates, because I am bound to allow a larger sum at the end. That is the only difference between us as regards expenses and the net receipts. The first point of difference relates to the tenant's profits. Mr. Ryde makes the amount £927; I make it £455. I take Mr. Ryde's figures with regard to coal, but I strike off the residuals; and this constitutes the difference between £3187 and £1345. Upon the total, in round numbers, of £3500 Mr. Ryde has taken 5-12ths; I have taken 3-8ths—a difference only of 1-24th. For meters I do not allow anything, on the ground that the tenant is not required to find the money to pay for them. I allow for two months stock of coal, and for cash at the bankers. Mr. Ryde makes the tenant's capital £5300; I make it £2600. I have always adopted the proportion of 3-8ths. It will be found that £400 is allowed by way of discount because the money is paid immediately. The Company actually hold deposits upon the accounts, upon which they allow 5 per cent. interest. Under those circumstances, I do not feel justified in increasing the 3-8ths. I allow 17½ per cent. on the tenant's capital. The deductions and allowances I put at £665. For repairs I allow £269 as the money usually spent for the year in ordinary repairs, without taking into account that portion of the wages which may have been for work done upon repairs. I have adopted Mr. Ryde's values of £7000 for apparatus, £7000 for buildings, and £6000 for mains. I have also adopted his 4 per cent. tables. The difference between us is the number of years of life that I have allowed. I have taken the buildings at 40 years life. Buildings I generally take at about 100 years, but I cannot say that these are particularly first-class buildings, and I have taken them at 40 years. I have known retort-houses that will last 100 years, but they are not this class of building. I have allowed 20 years for the apparatus, the same amount of life as Mr. Ryde has taken as an average, so that as regards this item I adopt his figure. I was told the works had been built 20 years. I saw upon one of the buildings an iron plate having upon it the words: "Built in 1858," and I accepted the fact; therefore some of the mains and pipes must have been down for 22 years. For the mains I allow 40 years life; that is about the ordinary life we allow, as a rule. It is a very short life, under ordinary conditions, for gas-mains. The specimen pipe produced I do not think I should have put down at less than 40 years of age. Supposing it to be a fair specimen of some pipes, in very bad situations, I should not be at all disposed to modify my view in consequence of this. I have not made a distinction between the life of mains and service-pipes. As a rule, we do not provide for the replacement of service-pipes, because the life of a service-pipe is so small; it is generally allowed out of ordinary expenditure. I add insurance £35, and make the total deductions allowed £665. That gives the total £2463, from which the rates have to be deducted. Deducting £531, being at the rate of 5s. 6d. in the pound rateable value, you get £1932 as the net rateable value. About £60 of this amount lies outside the parish of Minster, so that this must be deducted.

Cross-examined by Mr. MICHAEL: I prepared this statement last night. I made a statement for the purpose of advising the Assessment Committee, but it does not correspond with this one. The basis upon which the rate has been made is not this statement. I cannot give you the original statement. It was made at the time I was in general ignorance of everything, and was for the purpose of arriving at a valuation to be afterwards settled.

Mr. MICHAEL: Shall I say it was a statement entirely different from the statement you put in?

Witness: Oh, no; not entirely different.

You do not mean to say this statement at all accords with the statement upon which the rate has been struck?—It is above it.

The amount put in the rate is £1480; this is £1932. Do you not think I am entitled to ask you how this difference arises? Did you not send in a statement upon which the Company were rated at an assessable value of £1480?—I do not know what you mean by a "statement." I signed a valuation for £1480, which the Assessment Committee adopted.

And you bring in a net statement before the Arbitrator for £1932?—I do.

Which is the correct one?—Neither the one nor the other. You cannot make an estimate mathematically correct at all. I invariably knock off 10 or 15 per cent. from my valuation, in order to guard against points with which I am not acquainted.

What is the difference of percentage between that which you present to-day to the Arbitrator, and that which formed the basis upon which the rate was struck?—About 25 per cent.

Cross-examination continued: In order to ascertain the value before I sent in my valuation, I went over the works and applied for the yearly accounts. The year's accounts consist of two statements—one of income and expenditure, and the other the trade account. The items not agreeing, I was obliged to flounder my way till Mr. Spice and I met. I was obliged to adopt the item of £515 for repairs and renewals in my first estimate, because I could not subdivide it; but as soon as I found what was included I did subdivide it, and did strike out a portion of the account because it had not been absolutely expended. I have taken the actual repairs that I found in the accounts during the last year—the absolute money expended, £285, which was not enough to keep the premises in sufficient repair as landlord. I allow £630 as the yearly expenditure. That is the sum I say ought, on an average, to be spent either by the landlord or the tenant, or at all events it ought to be put aside as a sinking-fund for drawing upon when required. The £269 is for repairs, and £360 for renewals. I do not know how many retorts would require to be renewed every year.

SATURDAY, DEC. 18.

At the meeting of the parties to this case to-day, Mr. *Castle* was recalled, and produced a letter which he had received from the Secretary of the Company, enclosing a balance-sheet for 1877-8, and stating that the yearly accounts for 1879 were not completed. His estimate, he said, had been based on the accounts of 1878, but he had not been able to find it. Neither the original estimate nor the present one was quite right. The 1878 account was based upon the figures for 1878, which had ceased to be applicable. As to the subsequent estimate, based upon the 1879 figures, this was a question for the Court. He would not assume that it was right—perhaps it was wrong. He thought it was fair, but he would not say it was right.

Cross-examined by Mr. MICHAEL, witness said he could not state the date of his appointment to make a valuation for the parish, but it must have been before January last, because this was the date of the letter.

Mr. MICHAEL called for the minute-book of the parish, which was produced, and a minute was read from it, dated March, 1880, asking the terms upon which the witness would make a valuation.

Witness said he could not explain the statement that he had been appointed before January, when he had been asked in March what his terms for valuing would be. He would not undertake to say what was the time of his appointment.

Mr. MICHAEL: You say you could not get the accounts in January. You were appointed to do the work on the 31st of March, and the accounts were published before that time.

Witness: I cannot account for it.

Did you ever visit the works before the valuation was sent in?—I really do not know. The firm did; whether I did personally I cannot tell.

Re-examined by Mr. CASTLE: Having had the opportunity of refreshing my memory, I suppose I did not make the valuation until after the 31st of March.

Mr. *G. W. Stevenson*, examined by Mr. CASTLE.

I have been an Engineer 35 years, and have had considerable experience in reference to the rating of gas-works. I have estimated the rateable value of this property, and have proceeded on the assumption that the actual expenses shown in the Company's balance-sheet are the expenses which the tenant will have to undertake. I presume that a gas company knows how to manage its business in the best way. I have taken the working expenses, £4309, from the balance-sheet, deducting residuals. Tenant's capital I take at three-eighths of the expenses, £1612; coal and lime, two months, £537; stores and tools, £400; half rates and taxes,

£225—total, £2774. I have given the occupier 17½ per cent. on this amount —£485—leaving £2099 as the gross estimated rental. I find, on looking at the accounts for 1879, that the whole working expenses, excluding the cost of raw material, amount to 17¼d. per 1000 feet of gas. I have looked at the expenditure of some of the Metropolitan Gas Companies for repairs and renewals generally (they make no distinction between them), and I find that 17¼d. is in excess of what the South Metropolitan, or even The Gaslight and Coke Company, have ever spent for repairs and renewals. In 1879 the accounts not only include current repairs, but £125 for rebuilding a shaft, and £130 for depreciation. In 1870 the Company spent £166; in 1871, £132; in 1872, £161; in 1873, £162; in 1874, £114; in 1875, £124; in 1876, £178; in 1877, £229; in 1878, £395; in 1879, £515; being an average of £217. The £515 in 1879 includes £385 actually expended, and £130 carried to estimated depreciation. The sum which, set aside at 4 per cent. compound interest, will produce £22,000 for renewal of works, plant, and distributing apparatus at the end of 30 years, is £392; insurance, ½ per cent., £35; making the statutable deductions, £427. This leaves a balance of £1672; deducting additional rates to make 5s. 6d. in the pound, £160; leaving the net rateable value £1512. The rate was made in July, 1880. The money spent on repairs in 1879 sufficed to maintain the structure in a position to earn the rent, and a similar amount for the last ten years has done the same. I have examined the premises, and I think certain repairs require to be done. The bad parts of the works are the retort-house and the coal-store; they were never properly constructed, and they are now in a dilapidated condition. They have existed for 20 years, and I have no doubt they have been gradually getting more and more out of shape. The foundation was not good, the walls were not built upon piles, as they ought to have been, and they were altogether too light. It was a contractor's job, and it was a bad one. If, however, the retort-house and the coal-store were to tumble down to-morrow, it would not prevent the works being carried on and the rental being earned. For many years the retorts at the Nine Elms Gas-Works were out in the open, having no cover whatever; but I do not recommend this. I should agree with what Mr. Penny recommended, and I should not quarrel with his estimate. All the things he has recommended would be very good, but they are not necessary for the purpose of earning the rent. The rent has been earned by the works in their present state. I should myself be glad to give the amount I have estimated—£1512—for the works. I think they would let for this amount in the market. If the sum I have named for renewals had been saved from year to year, there would now be ample funds in hand to do all that is necessary, and a great deal more. If the sum named by Mr. Ryde had been appropriated—£1695—and only the small amount spent which has been stated, there would have been a fund of about £40,000. It would be preposterous to set aside such a sum, with regard to the Companies referred to as spending sums varying from 3d. to 6d. I may mention that the two Companies alluded to by Mr. Ryde—the London and the Phœnix—have avoided going to Parliament for years, although their capital has been pretty well exhausted, because they did not want to put themselves under recent parliamentary obligations, and they have been spending out of revenue large sums of money on their extensions. The figures quoted by Mr. Spice included not only repairs and renewals, but actual extensions. It is not fair for the Sheppy Company to start now and say, "We are going to set aside a renewal-fund." My attention has been called to the case of *Reg. v. The London, Brighton, and South Coast Railway Company* (15 Q.B., 313) which shows that the Company have no right to do this. I have been a lessee of gas-works, and know it is not the custom for tenants to find the capital for the meters. I have never known a case in which this has been done. The meters are valued to the incoming tenant, and they are valued again when his lease expires. I agree with the answer of Mr. Hawksley in the Lee case. He was asked, "What would any tenant taking gas-works have to pay for, independently of the rent? Would he have to pay for retorts and meters?" And he replied, "Yes, he would, according to a well-recognized practice in making estimates of this kind." According to a well-recognized practice in making estimates of this kind, people do include a sum for the purchase of meters, but in practice it is not so. In my estimate I have given the tenant all the expenses he actually incurs, and have allowed £130 for depreciation, and I am certain that it is ample. If I had the works I should not use so much capital in them. I have not allowed anything for cash at the bankers. Country bankers do not require a "rest," like most London bankers. If it had been a London Company I should have made an allowance of £300 or £500.

Mr. CASTLE said he wished to withdraw his remark about the accounts being made from the figures of 1878. There had evidently been some confusion and misapprehension. He thought, however, it was hardly fair that a witness should be asked to compare his estimates in the way Mr. Castle had been asked. The chief points of difference between the witnesses with reference to the tenant's capital related to the meters and the residuals, but the most important question of all in dispute was the amount to be allowed to the tenant for repairs and renewals. Mr. Stevenson had given the actual figures taken from the Company's books, and stated that £427, including £35 for insurance, was sufficient to provide a renewal-fund; but the Company now wanted to start a renewal-fund for the first time, and said that the premises had fallen into decay, so that during the next 20 years £20,000 would be required. This was not in accordance with law. The premises had been in a state to command the rent, and the amount now required for repairs was purely a question for the Arbitrator. The Company had no right to claim the large sum they insisted upon for doing what had hitherto been done for £150 a year. If the Company had done what it was said they ought to have done, and which they were estopped from saying they had not done, they would have saved, according to the Company's figures, £1500 every year for the last 20 years, which would have provided a renewal-fund of £40,000 or £50,000—a sum they could not require. Mr. Penny said all that was required was £5000, and he thus put the Company out of court. There was also another way of looking at the matter. If the works were let at a private rental, taking the gross amount, as given by Mr. Ryde, at £2449, under the Metropolis Valuation Act, a third would be taken off, and this would bring the net value to £1600, which was somewhat above the rental assessed by the parish. There was really no reason why gas-works should have a larger amount taken off than private works; according to Mr. Ryde, however, there was a deduction of 70 per cent. instead of 33 per cent., which showed that the whole calculation was ridiculous.

Mr. MICHAEL, in reply, said the only two material points were the amount of the tenant's capital, and the amount of the statutory deductions. As to the percentage to be allowed on the working capital of the tenant, it appeared that 17½ per cent. had been allowed in Mr. Castle's original valuation, and in the valuation which he presented to the Arbitrator. Mr. Castle had apparently gone upon the supposition that the Arbitrator would add together the sums given on one side and on the other, and divide them by two, and on this account had raised his estimate £500 above that originally made. He had never given any gross estimated rental, from which anything could be deducted. Mr. Stevenson's figures in no way supported Mr. Castle's valuation. The net receipts of the Company, according to Mr. Castle, were £3583; while according to Mr. Stevenson, they were only £2584. The occupier's share, according to Mr. Castle, was £455; and according to Mr. Stevenson, £485. The statutable deductions, according to Mr. Castle, were £665; and according to Mr. Stevenson, £427. There was no accord whatever between the figures; indeed they were mutually destructive. According to Mr. Castle, the tenant would have to pay to the landlord, after all deductions, about £1940. The accounts of the Company had been put in, and it appeared that the capital consisted of 400 "A" shares, amounting to £4000, entitled to a dividend of 4 per cent., or £160, and £19,743, entitled to 10 per cent., or £1974, making together £2134. It was absurd, on the face of it, to suppose that a tenant or a company should pay in rent £1940 for the chance of earning £2140. The Company could not divide more than this profit, and it was ridiculous, therefore, to suppose that they should pay such a rent. Mr. Castle had said that in January, 1880, he applied for the accounts in order to make a valuation of the works; but he was obliged to base his valuation on the accounts of 1878. It appeared, however, that his appointment as valuer only took place on the 31st of March, 1880, which was 26 days after the accounts of 1879 had been published. But the accounts of 1878 did not support Mr. Castle's contention any more than the accounts of 1879. He had not treated the accounts fairly. He had given 30 years as the life of the works, whereas in truth it was obvious that they had not lasted 20 years, because some portions had been re-constructed, and, according to the evidence, the whole concern was in a ruinous condition. Mr. Castle had merely allowed the money absolutely expended, and allowed nothing to be put aside from year to year. According to the judgment of Lord Coleridge in the Brighton case, the Company ought to set apart the sum which they claimed to deduct; but, if they did not, they could not be compelled to do so, but were still entitled to the deduction. According to the evidence, the average life of the works was about 16 years, although if they had been ordinary works, built under ordinary conditions and upon ordinary soil, they might have lasted 30 years. He maintained that the Company were entitled to deduct what ought to have been laid aside, although it had not been actually laid aside for purposes of renewal, taking the life of the works not at 16 but at 20 years. He was surprised to hear Mr. Stevenson say that if the works fell down the Company could still continue to supply gas just as well. It was preposterous to suppose that the Company could carry on its business with the retort-house and the coal-store in ruins. Mr. Stevenson had made another rash assertion—that the only thing supporting the charge of 6d. per 1000 feet for wear and tear was the fact that there were two London Companies who alone were working under the Act of 1860, and were not subject to modern statutory regulations. There were, however, no statutory regulations since 1860 which affected the case at all. With regard to the allocation of capital and revenue, the whole matter of legislation remained entirely unchanged. It would be found according to Mr. Field's "Analysis" that in the greatest Gas Company in the world—The Gaslight and Coke Company, which had been the subject of legislation almost every year since 1860—the charge for wear and tear for 1879 was 5·93d., which strongly supported the case of the Appellants. If, however, they took it upon the amount of coal consumed, instead of upon the gas made (the production of gas being more economical in a large company), a higher figure than 6d. per 1000 feet would have been justified. As to the question of meters, it was absurd to suppose that the tenant should not be allowed for them. Their life was but short, and in the course of 20 years there would not be a single meter that he would not have paid for. With regard to the sum required to renew the works, Mr. Stevenson had given £22,000, instead of £20,000; and, taking 20 years as the duration, the annual sum required would be £726 instead of £660.

This concluded the case, and it was arranged that the Arbitrator should visit the works before giving his decision.

CONTINENTAL UNION GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held at the London Offices, Drapers Gardens, E.C., on Tuesday last—HENRY M'LAUCHLAN BACKLER, Esq., in the chair.

The SECRETARY (Mr. H. John) read the notice convening the meeting, and also the following report of the Directors:—

The printed annual report of the *Union des Gaz* Company now lying on the table will be found to contain the details of the works carried out in the various stations of that Company during the past working year. These works, amounting to £15,113, were rendered necessary by the constantly increasing consumption of gas in the towns where they were carried out.

A further sum of £6750 was expended on the purchase of land at Milan and at Vienne, for the future extension of these stations.

The concession for lighting the town of Parma was recently renewed for 17 years, on conditions which, although not so favourable as those of the expiring contract, are nevertheless satisfactory, and will probably lead to considerable extension of business.

All the concessions, both in the *Union des Gaz* and the Continental Union Gas Company, are thus, with the exception of one, the renewal of which is now being negotiated, secured for long periods, that of the least important station expiring in 1897, and the most important ones from 1907 to 1924.

The excellent averages of manufacture of the past years have been maintained, and in some cases improved. The unusually cold winter of 1879–80 was severely felt in several of the towns lighted by the Company, causing the rupture or obstruction of mains and services, thereby increasing the leakage, and in some measure restricting the consumption of gas; but the results of these unavoidable accidents were more than compensated by an active demand for household fuel in many of the localities supplied, thus raising the average price of coke 8 per cent. over that of the previous year. The cost of the coal distilled at the same time shows an aggregate reduction of about 11d. per ton.

The sale of gas has increased about 4 per cent; the number of private lights gained during the twelve months being 10,034. The amount of bad debts is still less than last year, the total being only £320 on a gross rental of £350,000.

In the Continental Union Gas Company's stations the outlay on new works has been limited to £400, chiefly for new mains.

During a violent gale at Messina, one of the gasholders, at the time under repair, suffered material injury, and measures are being taken to reinstate it for effectual use as soon as possible.

The Proprietors will observe, by the accounts now produced, that the net profits have increased from £57,163 18s. 3d. to £64,416 2s., which admits of an addition of ½ per cent. to the rate of dividend. The Directors therefore declare a dividend at the rate of 7 per cent. per annum, free of income-tax; carrying forward to next year's account a balance of £6942 7s. 4d. The interim dividend of 2½ per cent. paid on the 4th of July being deducted, the balance of 4½ per cent. will be paid as usual on the 4th of January next.

The Directors anticipate that the interests of the Company will be largely benefited by the National Exhibition to be held next year in Milan, and for which preparations on a vast scale are already being made.

Energetic means are being adopted, at all the establishments under the management of the Directors, to afford facilities for the development of the use of gas. In some cases these efforts have proved remarkably successful. It may therefore be fairly anticipated that the business will continue to progress favourably, and that the results will prove more and more satisfactory.

The amount of the debenture debt of the Company has been reduced from £193,135 to £113,040 in the course of the financial year.

The retiring Director is Edward Garey, Esq., who, being eligible for re-election, offers himself accordingly.

The retiring Auditors are Alfred Hersee, Esq., and Frederick Tendron, Esq., who, being eligible for re-election, offer themselves accordingly.

The CHAIRMAN, in moving the adoption of the report, said he would not detain the meeting with many remarks on this occasion, because, judging by the applause which greeted one paragraph in the report, it appeared to him that the salt of anything he might say was already taken out by the

announcement of the increased dividend for the year. There were, however, one or two points to which he would like to call attention. The chief one was the length of the Company's concessions, adverted to in the report. By the addition made to the number of years, the position of the Company, through the *Union des Gaz*, had become much better assured than it was previously, and the only station in which they now had a short term was about to have its concession renewed. There was very little doubt that they would be able to effect this, so that practically they were better off abroad than in England, where they might be upset at any time by an Act of Parliament giving rise to fresh competition. There were several reasons why the profits were not so large as they might be, even though they were considerably in excess of the previous year. One was that in order to obtain the concessions referred to, the Company had had to reduce the price of gas in several of the cases, and they had not at once recouped all the difference in this respect. There was no doubt they would do so by degrees, and find that the concessions to which they had thought it wise to give their assent would be the means of producing a very much better revenue in the future than they had realized in the past. Another point which required attention was that of exchange. The exchange for several years had been very much against the Company, and they had lost large sums by the difference; but within the last few months the rates had improved to a considerable extent, and there seemed to be good ground for thinking that the improvement would be continued, and that in the current and future years they would derive great advantage therefrom. Of course, this must be problematical to some extent, but there was good reason to think it would be carried out. As regarded the business of the Company, it would be seen that they were doing well, that they had maintained all the improvements they had introduced in the manufacture, and the business was growing, owing to the encouragement they were giving in the matter of fittings. They made it a study to see how the consumption could be developed, and they found that it could be assisted to a great extent by facilitating the acquisition of fittings. It was a small outlay of capital for the time, but it was returned by degrees, and meanwhile the consumption of gas was increased to a considerable extent. The outlay on this account had been kept within a very reasonable limit. Of course, in every gas company it was necessary to make some outlay, because the increased business required it; but the object of a careful board of management should be, and here was, to keep such outlay within the closest limits possible. There was one more point he must mention. The Directors had very great expectations from the exhibition to be held next year in Milan. Vast preparations were being made for it, and the project was being taken up in a spirit which augured well for its success. It could not be successful without bringing with it an increased consumption of gas, and although this was an exceptional circumstance, still when consumers took to burning gas on a larger scale, it was generally found that some portion of the increased consumption remained afterwards. The Shareholders would have observed a remarkable circumstance in the report—viz., that while the cost of coal was less, the Company had obtained more for their coke. This was owing to contracts that had been made for coal some time ago, by which a considerable reduction was obtained upon prices previously paid. The reason the price of coke had not agreed with this was that the Directors made very few contracts for its sale, and were able during the last severe winter to take advantage of the increased demand for that article. This explained a feature which might otherwise be perplexing. With regard to the future of the Company, it seemed to bear a very flourishing appearance. The lights had increased everywhere, and not only the lights, but there was also a disposition to apply gas to purposes for which it had only been used to a small extent in former times, particularly for heating and cooking, and for motive power. The Directors had succeeded in placing a good number of gas-engines in several of the towns in which the Company's business lay, and so far their enemy, or should he say their friend, the electric light, had been of service to them, because it might cause gas to be employed as a motive power for working the electric machines, and hence the Company would obtain some benefit from it. Wherever the electric light had been introduced, it had not been found to have the slightest effect on the consumption of gas; on the contrary, the Company's business had increased in the same, and in some places even in a greater ratio, since its introduction. With regard to the debentures, that which he stated at previous meetings was about to be done in order to reduce the amount of debenture debt had been carried out to the full extent, and this debt had been brought within reasonable limits. The amount was now reduced from £193,000 to £113,000, which could never be a peril such as was the original amount in former times. On the whole, he considered that the Company's position was improved, and that they were likely to do well in the future. Above all, they were perfectly safe as regarded their financial condition.

Mr. W. WHITE (a Director) seconded the motion.

Mr. F. TENDRON said he should like to know in what way the electric light had benefited the Company. Did the Chairman merely mean that the general influence which improved lighting had upon the minds of the public led them to consume a larger quantity of gas?

Mr. LOVEJOY asked if the Company had anything to fear from the Brush light, which was being much extolled just now. Were the concessions granted to the Company in exclusion of any other company coming upon their ground. There would, he supposed, be some legal power to prevent any such interference. The electric light was said to be coming into use in France, Italy, and other countries. In what position did the Company stand with regard to the introduction of any light that might affect their interest?

The CHAIRMAN said the electric light had been in operation in some of their largest cities—to wit, Strasburg and Milan—and on a smaller scale in one or two other places. The object of the trials was to show what could be done in the way of electric lighting, and the effect was that when the experiments were discontinued, a greater demand for gas was caused, owing to the power of light which had been exhibited. He believed the Brush light to be one of the best electric lights that had been brought out. It was, however, open to the inconveniences of other systems, and chiefly with respect to the multiplication of electrical machines. If it were possible to apply it to private dwellings, machines would have to be introduced into one of every few houses, in order to produce this light for domestic purposes, and they would require to be in duplicate, as they were very likely to break down. This would increase the expense, and all calculations about the electric light he had seen were estimated upon the lowest possible basis. The Company's concessions were exclusive privileges for laying gas-mains. There was nothing in the world to prevent an electric light company supplying their towns, if it could be done; but, generally speaking, this Company had a right to the preference. The development of gas abroad had not been so great as in England. He believed that in the course of time the means the Company were adopting for reducing the price of gas would lead to its further development.

Mr. R. H. JONES remarked that the increased dividend was quite as much as the Company could afford to pay, and, even as it was, they carried forward £500 less than last year.

The CHAIRMAN said the Company derived its principal revenue from the *Union des Gaz*. There was a *réserve statutaire* of 5 per cent. on the profits, which amounted to £27,000, and, in addition, that Company were paying off out of revenue all their bonds as they fell due, and the accrued reserve from these sources amounted to £127,000. Their reserve was practically this Company's reserve. They were quite safe in the dividend if they paid all they earned and left not more than 6d. as a balance.

The motion was carried unanimously.

The retiring Director and Auditors having been severally re-elected,

Mr. BADDELEY proposed a vote of thanks to the Board for the great zeal and diligence they had shown in carrying on the affairs of the Company during the past year.

The motion was seconded and carried unanimously.

The CHAIRMAN briefly returned thanks, and the proceedings closed.

SOCIETY OF ENGINEERS.

The Twenty-sixth Annual General Meeting of this Society was held on Monday, the 13th inst.—Mr. JOSEPH BERNAYS (the retiring President) in the chair.

The following gentlemen were balloted for and duly elected as the Council and Officers for the ensuing year, viz.:—President, Mr. Charles Horsley; Vice-Presidents, Mr. Jabez Church, Mr. F. E. Duckham, and Mr. Arthur Rigg; Ordinary Members of Council, Mr. S. Cutler, Mr. C. Gandon, Mr. P. F. Nursey, Mr. T. Porter, Mr. W. Schönheyder, Mr. R. Berridge, Mr. C. J. Light, and Mr. H. Robinson, the three last-named gentlemen being new members of the Council; Honorary Secretary and Treasurer, Mr. Alfred Williams; Auditor, Mr. W. H. Bennett.

The PRESIDENT announced that premiums of books had been awarded by the Council to Mr. G. M. Ward for his paper on "The Utilization of Coal Slack in the Manufacture of Coke for Smelting," and to Mr. W. Worby Beaumont for his paper on "Steel as a Structural Material."

The proceedings terminated by unanimous votes of thanks being passed to the President, Council, and Officers for 1880.

On Wednesday last the annual dinner of the Society took place at the Guildhall Tavern—the chair being occupied by Mr. Bernays. The two vice-chairs were respectively filled by Mr. Charles Horsley and Mr. Alfred Williams. The company numbered over 100 of the members and associates of the Society and their friends. After the usual loyal and patriotic toasts, the Chairman proposed "Success to the Society of Engineers," coupling with the toast the name of Mr. Alfred Williams. The health of the President was proposed by Mr. R. P. Spice, and responded to by Mr. Bernays, who then proposed the health of the President-elect for the ensuing year—Mr. Charles Horsley. Several other toasts were proposed and responded to. During the evening a selection of music, under the direction of Mr. Montem Smith, was performed.

SOME NOTES FROM AMERICA.

(FROM OUR OWN CORRESPONDENT.)

The eighth annual meeting of the American Gaslight Association, held in Chicago, on Oct. 13, 14, and 15, was of a very interesting character. The length of the meetings was extended from two to three days, thus affording a better opportunity for the discussion of the papers presented, and allowing more time for social intercourse. The President delivered a practical and timely address to the members, one remark of which, in particular, cannot be too warmly endorsed—viz., that "our companies should make their money as all large manufacturing industries in the long run make theirs—by large sales at a small percentage of profit. . . . . Our only real competitor is petroleum." In this country petroleum is the only real competitor of gas. Affording, as it does, a very cheap light, it has become a formidable rival; for many improvements have been made of late in lamps and burners, so that a good light can be obtained from oil with comparatively little danger. However, accidents do frequently occur from the use of this illuminant, owing chiefly to the employment of poor oil and obsolete lamps. The superior cleanliness of gas is greatly in its favour; consequently, where gas is sold at a low figure, it quickly supplants petroleum.

An officer of the New York Board of Fire Underwriters called attention, in a recent number of the *Scientific American*, to an incident which lately happened in New York City in connection with the electric light. The facts of the case are briefly told:—A wire in connection with an electric light was being moved on the roof of a building, when it fell on a telephone wire, with the consequence that sparks burst from the transmitter connected with the telephone in an adjacent building, the heat being so intense as to destroy part of the apparatus.

The Edison Electric Light Company have levied an assessment on their stockholders of 60 dols. (£12) per share. The capital of the Company is 300,000 dols. (£60,000), which has been used for experiments. Besides this a considerable sum has been borrowed; and the assessment is to pay this borrowed capital, and afford the means for further experiments. *A propos* of this subject, I may mention that the Edison light is still imperfect. It seems that the carbon loop is again the weak point, the material of which it is made being unsatisfactory. To overcome this trouble it is said that Mr. Edison has employed Mr. Branner—a gentleman who has travelled considerably in South America—to search through Brazil to find some species of fibreless palm, of which it is proposed to make the loops. Mr. Branner expects to be absent a year.

Several accidents in connection with gas have recently occurred in this country—some fatal cases of suffocation by gas, and one explosion. The latter happened in a building in New York City. A leak of gas in the cellar was noticed, and the porter took a lighted candle to investigate, with the usual result. The man was considerably, but not fatally hurt; and some slight injury done to the house. Such accidents as these are of less frequent occurrence in America than on your side of the ocean. The system of inspection of gas-fitting in vogue in most of the large cities here accounts for this in a great measure. The gas companies lay down certain rules to govern the running of pipe, chiefly in regard to the number of lights, and the length allowed for each size of pipe; also the mode of fastening and securing the same. A fitter, after having finished piping a building, is required to notify the gas company, who send their inspector to see that the rules have been complied with, and that the work is tight. If all is satisfactory, the gas company give the fitter a certificate to that effect. As the builders co-operate with the companies in this matter, a fitter cannot collect his bill until he can show the gas company's certificate. By this practice much bad and dangerous work is prevented.

P.S.—Since closing my letter, another and a very serious explosion of gas has occurred. The scene of the accident was a large five-storey iron building in one of the down-town streets of New York City. A strong odour of gas was noticed in the cellar, and a fitter was sent for, who, after examining the pipes in the cellar and failing to find the leak, went into the large vault which extended under the sidewalk. Here the meter was situated; and, either through stupidity or thoughtlessness, he struck a light as he entered the vault. Immediately a terrible explosion occurred destroying the walls and arches of the vault, and also part of the founda-

tion wall of the building. Fortunately the vault was open the entire width of the building, so that a great deal of the force of the explosion was spent inwardly, otherwise the sidewalk would doubtless have been blown up, and many passers-by injured. Two gentlemen, clerks in the building, were seriously hurt, one, it is feared, fatally; while the fitter escaped with several bad cuts.

METROPOLIS WATER SUPPLY.

The Registrar-General publishes the following table in reference to the Water Supply of London during November. According to returns furnished to him by the Metropolitan Water Companies, 137,063,766 gallons, or 622,743 cubic mètres of water (equal to about as many *tuns* by measure, *tons* by weight), were supplied daily, or 229 gallons (104·0 decalitres), rather more than a *ton* by weight, to each house, and 32·2 gallons (14·6 decalitres) to each person, against 32·4 gallons during November, 1879.

Companies.	Number of Houses, &c., supplied in Nov., 1879.	Nov., 1880.	Aver. Daily Supply of Water in Gallons* during Nov., 1879.	Nov., 1880.
Total supply	573,142	599,116	131,877,907	137,063,766
From Thames	274,709	287,440	67,467,984	69,355,636
,, Lea and other Sources	298,433	311,676	64,409,923	67,708,130
Thames.				
Chelsea	29,945	30,420	8,104,000	8,295,000
West Middlesex	53,450	56,020	10,065,908	10,466,118
Southwark and Vauxhall	88,333	92,182	24,088,949	23,873,593
Grand Junction	40,285	42,957	11,818,627	11,720,225
Lambeth	62,696	65,861	13,390,500	15,000,700
Lea and other Sources.				
New River	129,461	132,245	26,338,000	25,666,000
East London	120,459	128,413	30,418,500	33,968,000
Kent	48,513	51,018	7,653,423	8,074,130

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for November, 1880, as compared with that for the corresponding month of 1879, shows an increase of 25,974 houses, and of 5,185,859 gallons of water supplied daily.

The following is Dr. Frankland's report of his analyses of the water supplied to London during November:—"Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies, and by the Tottenham Local Board of Health, was—Colne Valley, 1·6; Tottenham, 1·8; Kent, 1·9; New River, 2·7; Lambeth, 4·3; Grand Junction, 4·3; Southwark, 4·7; East London, 5·0; Chelsea, 5·7; West Middlesex, 6·5. The water drawn from the Thames by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies exhibited a marked improvement in quality upon that supplied during the months of August, September, and October, and it had been in all cases efficiently filtered before delivery. The water drawn from the Lea by the New River and East London Companies was also of superior quality to that supplied last month, that sent out by the New River Company being considerably better than Thames water, whilst that distributed by the East London Company was equal to average Thames water. Both waters were efficiently filtered. The deep-well water supplied by the Kent and Colne Valley Companies and by the Tottenham Local Board of Health was of its usual excellent quality for dietetic purposes, and the Colne Valley Company's water was also soft, and therefore well suited for washing. Seen through a stratum two feet deep, the water presented the following appearances:—Kent, Colne Valley, and Tottenham, clear and colourless; New River, clear and very pale yellow; Chelsea, West Middlesex, Southwark, Grand Junction, Lambeth, and East London, clear and pale yellow."

Results of Analyses expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Matter.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen, as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Total Hardness.
Inner Circle.								
Thames—								
Chelsea	31·00	·294	·044	·003	·207	·254	1·5	21·8
West Middlesex	31·20	·290	·041	0	·283	·324	1·5	21·8
Southwark	31·82	·237	·042	0	·278	·320	1·5	22·0
Grand Junction	31·10	·190	·061	0	·239	·300	1·5	21·8
Lambeth	33·76	·210	·043	0	·286	·339	1·6	22·4
Lea—								
New River	31·04	·138	·022	0	·289	·311	1·6	20·9
East London	35·58	·245	·045	0	·258	·303	1·7	21·4
Deep wells—Kent	45·50	·092	·019	·001	·508	·528	2·8	28·4
Outer Circle.								
Colne Valley	13·56	·076	·018	0	·391	·409	1·5	6·1
Tottenham Local Board	41·14	·105	·012	·092	0	·087	2·9	26·4
Corporation of Birmingham*	25·50	·314	·023	·003	·418	·443	1·7	15·6
Corporation of Glasgow+	2·88	·131	·015	0	·006	·021	0·58	0·95

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
+ Analyzed by Dr. E. J. Mills, F.R.S., of Anderson's College, Glasgow.

Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

The Heat, Light, and Ventilation Exhibition, which was to have been held at the Alexandra Palace from to-morrow until the 11th prox., has been postponed for a few weeks, and will, according to latest arrangements, be opened on Jan. 26, and be continued to Feb. 12.

Tar and Tar Products at the Recent Glasgow Exhibition.—A slight inaccuracy occurred when calling attention, in the Journal of the 7th inst., to the statement presented to the Committee of Jurors on the secondary products of gas manufacture displayed at the late exhibition of gas apparatus, &c., at Glasgow. In the account submitted to the Philosophical Society, toluol and xylol were alluded to as substances separated from coal-tar naphtha, and which form the bases of new series of dyes and colouring matters. In the condensed account given in our pages it was made to appear as if the two substances mentioned were derived from nitro-benzole, which is not the case.

AMERICAN GASLIGHT ASSOCIATION.

[From the "Official Report" in the *American Gaslight Journal.*]

(*Continued from p.* 930.)

The paper read, after the discussion in respect to the Ross Stoking Machine, was one by Mr. G. G. Ramsdell, of Vincennes, Ind., on

GAS-ENGINES.

The author said he had prepared his paper with a sincere desire that it might contain just the information needed by any gas manager to enable him, in a business-like way, to successfully advocate the merits of gas-engines, and thereby secure their extensive use; and he had devoted much time and study to secure a fair and just comparison of their merits with those of the steam-engine. He also earnestly desired to remove any prejudice, and to draw attention to the facts as they were proved by every-day experience, and not theoretically. He wished to prove that not only were small engines, of 2, 4, and 7 horse power, economical, but also engines of greater power, and in the same ratio. He then continued:

I think you will agree with me that the idea has prevailed to a large extent that, while gas-engines were used successfully abroad, their general use in this country, where the price of gas usually rules higher, was impracticable. But is it not true that where there is a difference in the price of gas, a similar difference exists in the prices of other articles, and especially those that enter into the use of steam? My attention was strikingly called to this fact by the paper that Mr. F. T. Linton read before the last meeting of the North British Association of Gas Managers. By comparing his figures with those I shall lay before you in this paper, you will see that there is just about the same difference in the expense for steam as there is in the expense for gas. There are two gas-engines in operation in our city, and I have prepared figures in each case which I hope will prove of interest to you.

The purchase of the 17-horse power gas-engine, which is of the "Otto" silent type, was somewhat in the nature of an experiment, as no gas engine larger than 7-horse power had ever been used in this country, and as no gas-engine had been used, at least on so extensive a scale, for the same purposes—it being employed in an extensive grain elevator. For these reasons it was almost impossible to obtain reliable data as to the economy or adaptation of this class of engines to the work required to be performed, or any positive guarantee from the manufacturers, except that the engine should be as represented, and exert 17 indicated horse power. However, after much discussion and deliberation, it was decided to try it, and I was instructed to procure the engine.

When men seek for a motive power, economy in first cost and subsequent maintenance become the principal considerations. While all who have seen the large engine in operation have admired it, two-thirds of them have been sceptical as to the result of a few gas bills; but I am happy to say to you all that both the engines in use to-day in the city of Vincennes are, to their owners, who pay the gas bills, more than satisfactory in this as well as in every other respect. Experience has shown positively that the question of economy is no longer in doubt, but is satisfactorily known. Indeed, in the case of the 17-horse power engine, after four months constant use, running 16 hours per day for part of the time, and covering the busiest season of the year, economy is its chief characteristic. Therefore, in enumerating the superior advantages of gas-engines over steam-engines, I would say that they are cheaper in first cost and in subsequent use, and I think I can show to your entire satisfaction that such is the case.

As to the first cost, I find that many persons consider the price, especially of the smaller sizes of these engines, excessive; but upon careful and intelligent comparison, I doubt if any fair-minded person would hesitate to say that a first-class steam-engine of equal capacity and durability, with its necessary attachments, is as expensive in first cost, while in a year's use the gas-engine is incomparably cheaper; and I think I can prove this by a case in our own city, by figures which are actual, and taken from experience with the two engines. The proprietor of the *Daily Sun*, of our city, purchased a small Baxter improved upright steam-engine and boiler, listed at 150 dols., but for which he paid 125 dols. After four months use, and an outlay of over 40 dols. for repairs, he was forced to set it aside as useless. He then purchased an upright gas-engine of equal horse power, for which he paid 425 dols., and I submit the following comparison of cost:—

I stated that his repairs in four months amounted to a little over 40 dols.; but considering this unusual and excessive, I have calculated the expense for repairs on engine and boiler at 75 dols. per year, and although the engine virtually failed in four months, I have allowed it a lifetime of good working qualities of five years, and I think these estimates are probably fair. The showing would then be about as follows:—

Steam-Engine.

	Dols. c.
Engine and boiler	125 00
Repairs, 75 dols. per year; for five years	375 00
Attendance, 182 dols. per year; for five years	910 00
Coal, 1¼ bushel daily, 41·85 dols. per year; for five years	209 25
Kindling, 4 cents daily, 16·48 dols. per year; for five years	82 40
Oil, 12 gallons at 80 cents, 9·60 dols.; for five years	48 00
Extra insurance, 15 dols.; for five years	75 00
Total cost in five years	1824 65

Gas-Engine.

	Dols. c.
Cost of engine	425 00
Repairs, 15 dols. per year; for five years	75 00
Gas, 22·50 dols. per year; for five years	112 50
Oil, as above; for five years	48 00
Total cost of engine in five years	660 50
Total cost of engine, five years	660 50
Less value of engine, depreciation 35¾ per cent.	283 34
Net cost of gas-engine, five years	377 16

Recapitulation.

	Dols. c.
Cost of steam-engine and boiler, five years	1824 65
Cost of gas-engine, five years	377 16
Balance in favour of gas-engine	1447 49
Deducting cost of engine—	
Net cost of operating steam-engine one year	339 93
Net cost of operating gas-engine one year	47 10
Balance	292 83
Cost of operating steam-engine one day	1 08
Cost of operating gas-engine one day	15
Balance	0 93

If any are sceptical, and consider my figures upon any item excessive, please observe that what was paid for a boy engineer exceeded by 532 dols. 84 c. the entire cost of the gas-engine for the five years. Besides, there is ample room for varying the figures given to suit the prices ruling

in any locality. You will also notice that I have estimated the repairs on the gas-engine at 15 dols. per year; but the fact is, the engine has been in operation daily, except Sundays, for 22 months, and not a cent has been expended for repairs. Bear in mind also that in each case the same conditions prevailed. The gas-engine was set in the same place that the steam-engine occupied, ran the same machinery, and was operated by the same persons.

But it may be said that this is an extreme comparison—a good gas-engine with a poor steam-engine. Very good; let us see how it would show by taking a steam-engine of equal durability—calculating repairs on gas-engine one-third of repairs on steam-engine and boiler, other conditions remaining unaltered. The life of each engine would now be 15 years, and the comparison be as follows:—

Steam-Engine.

	Dols. c.
Cost of engine and boiler	425 00
Repairs on engine and boiler, 45 dols. per year; for 15 years	675 00
Attendance, 182 dols. per year; for 15 years	2730 00
Coal, 41·85 dols. per year; for 15 years	627 75
Kindling, 16·48 dols. per year; for 15 years	247 20
Extra insurance, 15 dols. per year; for 15 years	225 00
Oil, 12 gallons, at 80 cents per year, 9·60 dols.; for 15 years	144 00
Total cost of steam-engine for 15 years	5073 95

Gas-Engine.

	Dols. c.
Cost of engine	425 00
Repairs, 15 dols. per year; for 15 years	225 00
Oil, as above, 9·60 dols. per year; for 15 years	144 00
Gas, 9000 cubic feet, 22·50 dols. per year; for 15 years	337 50
Total cost of gas-engine for 15 years	1131 50

Recapitulation.

	Dols. c.
Total cost of steam-engine for 15 years	5073 95
Total cost of gas-engine for 15 years	1131 50
Balance in favour of gas-engine	3942 45
Deducting cost of plant—	
Net cost of operating steam-engine one year	309 93
Net cost of operating gas-engine one year	47 10
Balance in favour of gas-engine	262 83
Net cost of operating steam-engine one day	99
Net cost of operating gas-engine one day	15
Balance in favour of gas-engine	84

The cost of the same power performed by hand labour was 2 dols. 50 c. per week, costing in the same time 1950 dols., or 818·50 dols. more than the entire cost of the gas-engine and expense of operating.

Now it seems to me that this one engine affords ample illustration to satisfy the most sceptical; but I wish also to lay before you a comparison of the large gas-engine, as used by the Elevator Company, and I think you will agree with me that it affords a still stronger endorsement. In this, as well as in the former case, I have endeavoured to be as accurate, fair, and impartial as possible, using, where it was necessary to estimate, my own judgment together with that of others whose knowledge renders their opinions trustworthy, and taking actual figures in the case of the gas-engine. In my comparison I consider the engines of equal workmanship and durability, and as filling the same place and operating the same machinery, doing the entire work of the elevator during the ten hours of each working day in the year.

Steam-Engine.

	Dols. c.
Cost of 25-horse power steam-engine (Corliss)	1,320 00
25-horse power steam-boiler	615 00
Chimney, &c.	95 00
Furnace front, grates, &c.	80 00
Building for same	475 00
Engineer, 60 dols. per month, 720 dols. per year; for 25 years	18,000 00
Repairs on engine, 40 dols. per year; for 25 years	1,000 00
Repairs on boiler, 75 dols. per year; for 25 years	1,875 00
Repairs on furnace, &c., 25 dols. per year; for 25 years	625 00
Replacing boiler 1½ times	922 00
Erecting engine and boiler, &c.	365 00
Coal, 28 bushels daily, 8764 bushels per year, at 9 cents; for 25 years	19,719 00
Kindling, one-tenth of above	1,971 90
Water, 91 dols. per year; for 25 years	2,275 00
Oil, 56 gallons, at 80 cents, 44·80 dols. per year; for 25 years	1,120 00
Extra insurance, 160 dols. per year; for 25 years	4,000 00
Total cost of steam-engine for 25 years	54,457 90

Gas-Engine.

	Dols. c.
Cost of 17-horse power gas-engine	1,385 00
Erecting same	165 00
Repairs, 40 dols. per year; for 25 years	1,000 00
Oil, as before; for 25 years	1,120 00
Gas, 255,000 cubic feet, 511·80 dols. per year; for 25 years	12,795 00
Total cost of gas-engine for 25 years	16,465 00

Recapitulation.

	Dols. c.
Total cost of steam-engine for 25 years	54,457 90
Total cost of gas-engine for 25 years	16,465 00
Balance in favour of gas-engine	37,992 90
Deducting cost of plant—	
Net cost of operating steam-engine one year	2,093 91
Net cost of operating gas-engine one year	603 20
Balance in favour of gas-engine	1,490 71
Net cost of operating steam-engine one day	6 68
Net cost of operating gas-engine one day	1 92
Balance in favour of gas-engine	4 76

You will notice that in my comparison I have taken a 25-horse power steam-engine as against the 17-horse power gas-engine, and for this reason: Gas-engines are so constructed that they will instantly and at any time give out their full actual power, while a steam-engine depends entirely upon the boiler for its development of power, and as the generation of steam is, in practical use, more or less irregular, it follows that it would not be desirable to adopt a steam-engine of just the power required. Thus, in the case before us, had they not purchased the 17-horse power gas-engine, they would have bought an engine and boiler of 25-horse power. I have estimated the durability of the engines as equal, and the durability of the boiler at ten years. In my estimate of fuel I have taken the amount of bituminous coal necessary to supply the Corliss engine, probably as economical as any steam-engine in use to-day. It is also the rule laid down by Professor Rankine in his treatise on the "Steam-Engine." As to the price of coal, I of course take the price governing it where I live, and where the engine is operated. I have made no charge for water in the case of the gas-engine; it having pumped the small quantity of water it used with the gas consumed, it is charged to that account.

I feel assured that you will, upon investigating them, find that the figures are fair and just, and it would seem from them that in economy of first cost, in maintenance or expense of operating, the gas-engine has very decided advantages over steam; and as this, I might say, is the vital point in the case, it must be my excuse for dwelling thus largely upon it.

Another important economy is that of space—occupying less space than a steam-engine of equal power, while the latter requires the additional space necessary for the boiler, pumps, furnace, chimney, coal storeage, &c. Where the power is located in business houses and other places where space is limited, this becomes an important feature. There is a great economy in wear and tear, or durability, which is owing to superior workmanship, and the fact that all its working parts are lubricated perfectly by simple but effective automatic mechanism. In the convenience and ease with which it is managed there is absolutely no comparison. In the case of the *Sun* office steam-engine, the "devil" himself could not run it, and actually gave up his job through fear of an explosion. He now starts the gas-engine, and goes to his work leaving the engine to care for itself until the presswork is accomplished, when he stops it.

Another thing I would mention is the economy of gas. Its very sensitive governor adjusts to a nicety the supply of gas to suit the load placed upon it, so that the strictest economy ensues. The maximum of gas consumed per hour per horse power of work, as guaranteed by the manufacturers, is 21½ cubic feet. In the case of the 17-horse power engine, the most it has ever consumed was while shelling corn, under a very heavy feed, while testing its power, when the consumption was at the rate of 305 cubic feet per hour, and as this was about the full power of the engine, it would show that its maximum was about 18 instead of 21½ cubic feet per hour.

You can scarcely have an adequate idea of the perfect adaptability of this motive power for grain elevators—combining entire freedom from danger of fire or explosion, and, as shown, a great economy over steam. I have prepared from the Elevator Company's books a statement of the amount of grain handled by the engine during the four months of April, May, June, and July, and having made accurate tests of the gas consumed to perform the different classes of work, I can give you the exact figures:—

	Dols. c.
18,016 bushels of corn shelled, at 0·18 cent	32 45
10,555 bushels of grain drawn up an incline from the river, at 0·25 cent	26 38
15,577 bushels of grain fanned and dried, at 0·22 cent	34 27
110,720 bushels of grain elevated and loaded into cars, at 0·07 c.	77 50
154,867 bushels of grain, at a total expense of	170 60

This would be an average expense of 42·65 dols. per month—less by one-third than an engineer's wages, to say nothing of fuel, wear and tear, and danger from fire, &c. They have been able to start the engine in a few seconds, day or night, and are more than satisfied with the results accomplished.

I am convinced that the gas-engine will take the place of any medium-sized engine operated by steam, perform the work more satisfactorily, and at a reduced cost. Especially is this true where the work performed is intermittent. There are very many of the reasons why gas is the chief of all means of artificial light that apply in the same manner to the gas-engine. A very prominent one is its constant readiness for use; instead of the slow process of heating a large body of water, a turn of the wheel and the gas-engine is ready to give out its full power.

After a careful study of this subject, I fail to bring to mind in favour of the steam-engine a single argument that will stand the test of accurate and impartial comparison. In grain elevators, printing offices, workshops, stores, residences, &c., their instant and constant readiness for work, and their perfect safety, which leaves insurance unaffected, render gas-engines the cheapest, most convenient, and most desirable of any motor known.

Not long since two prominent architects from two of our larger cities visited our city for the purpose of investigating the merits of the gas-engine for elevators in ordinary business houses. After they had left I sat down and wrote to twelve parties who were using gas-engines for the purpose of passenger and freight elevators, inquiring as to their satisfaction, expense of running, &c. I received a reply from each one, in every case expressing complete satisfaction, and strongly recommending the engines for the purpose used—two of them mentioning the fact that in over a year's use they had not paid anything for repairs. Thinking the figures in this branch of work might prove of interest, I have placed them in this paper. Of the twelve replies, nine were in such a shape that the data could be used; the other three spoke only in general terms as to expense. Therefore, I give you the results of nine gas-engines in use at the present time for passenger and freight elevators and hoists:—

Total number of engines	9
Total horse power	33
Total number of hours used per day	83
Total number of hours used per month	2158
Total cost of gas per day	dols. 5·27
Total cost of gas per month	,, 137·25
Average number of hours per engine per day	9·15
Average number of hours per engine per month	240
Average cost per hour per engine	dols. 0·063
Average cost per day per engine	,, 0·585
Average cost per month per engine	,, 15·25
Average cost per hour per horse power	,, 0·0178
Average cost per day per horse power	,, 0·163
Average cost per month per horse power	,, 4·29

Add to this small expense the advantages of complete safety, unaffected insurance, economy of space, entire freedom from coal dirt, ashes, kindling, &c., together with the fact that the porter in the store can do all that needs to be done, and that, too, in a few minutes time each day—thereby saving an engineer's wages, and scarcely interfering with his own duties—and it does seem to me that you have the completest, cheapest, and most desirable motive power in use to-day.

The gas-engine is a comparatively new invention, and has only entered into a very few branches of industry; but there are new fields developing every day, especially in our large cities, that require just such a power as the gas-engine, and with such figures as these, taken from actual every-day experience, it will require but small effort to convince any fair-minded man who stands in need of such power, of its merits. All that is needed is knowledge on the subject, and the rapid introduction of these engines is assured. The importance of this to the gas interests of the country is very great, especially when it is taken into consideration that nine-tenths of the gas consumed would be in the daytime, when our mains are comparatively idle.

In conclusion, I would say that those who are provided with motive power will, in all probability, retain the power they now have, although I have shown that a gas-engine would be a good investment; but those contemplating the purchase of power, especially for light and intermittent work, can be influenced, and it is with this point in view that I have attempted to prepare this paper, and to embody in it such comparisons and information as can be taken and shown with convincing force to such consumers, resulting in an extensive introduction of these valuable engines.

(To be continued.)

NOTES FROM SCOTLAND.

(FROM OUR EDINBURGH CORRESPONDENT.)

EDINBURGH, *Saturday*.

In the JOURNAL for November 16, I thought it my duty to call attention to the condition of street lighting in the Metropolis of Scotland, and the state of matters was, I think, clearly shown to be anything but complimentary to the authorities who are responsible. Since those "Notes" appeared, I have not seen that any effort has been made to remedy the defects in the lamp governors, which are really past doing service, at least so far as the passage of gas is concerned; but I see that some attention has been bestowed upon the subject in another direction. I mentioned that Edinburgh could boast of possessing one flat-flame burner lamp of the Bray type, and that it was really doing good work in the position in which it had been placed—namely, at the west corner of the Post-Office, where there is an unusually heavy traffic, owing to this spot being central for the whole of the city tramway traffic. I might also have mentioned that here the traffic from the Port of Leith, from Portobello and the East, from Haymarket and the West, and from Newington and the South, converges, and that consequently until a somewhat late hour in the night, there is continual turmoil and bustle. An effort has now been made to redeem the credit of Edinburgh in respect of street lighting, and the result is so satisfactory that I should imagine the authorities will extend their improvements to other points where a larger blaze of light at night is much required. At the Register, five or six additional Bray's lamps have been erected, and these really do much to facilitate the traffic and to show off to some advantage the architectural beauties of the Register House and the General Post-Office. This is undoubtedly a move in the right direction. The next improvement must be the overhauling of all the governors attached to lamps, whether within or outside the parliamentary boundaries of the city.

The gas agitation in Montrose has subsided, but not before a sharp battle had been fought and won, as I was certain it would be, by those favourable to the adoption of the Gas Act, and the acquisition of the works from the present Company. The majority is certainly not very large, but it is sufficient. The constituency—that is, those who are entitled to vote on such a question—numbers 2026, and of these only some 671 took the trouble to come forward and vote. The numbers were, for the adoption of the Act, 373; against, 298—majority, 75. Although the town was well "worked," the number of electors who gave expression to their opinion is disappointingly small. I believe, however, that had the slightest doubt been entertained that the motion of the Provost of the town to acquire the gas-works would be in any danger of defeat, the townsfolk would have turned out in greater numbers to suppress the opposition. *A propos* of this question, I may mention that Dean of Guild Scott, who last week did so much to earn for himself the reputation of a prophet, has been twitted about a desire to which he has given expression to erect a handsome ornamental gas-lamp in the Links, which are at present being improved. It is this gentleman, be it observed, who speaks so hopefully of the ascendancy of the electric light, and so despondingly of the future of gas; and yet, instead of erecting an electric lamp, to show to his townsmen its immense superiority over gas, he goes away and pays for an ornamental gas-lamp. It is strongly suggestive of the story told of the ecclesiastic who predicted the end of the world within a few months, and who, nevertheless, took a lease for five or ten years of the house in which he was living. It may be that the Dean of Guild is erecting the lamp from purely philanthropic motives, and from a desire to utilize the works as much as possible after they have been acquired; but no matter how this may be, the gentleman has meanwhile done a proper and highly commendable thing in erecting the lamp.

The Hawick Gaslight Company met on Monday last, and then had under consideration the desirableness of removing their works from their present site. Owing to the successful manner in which Mr. Smith has managed the works during the past few years, the Directors feel warranted in coming to the conclusion that it would be advisable to make a move. At present the works are at a considerable distance from the station of the North British Railway Company, and consequently the cartages to and from the works form serious items in the accounts of the Company. It is calculated that the loss resulting from removal alone will amount to £3000, but it is anticipated that something like £300 a year will be saved on cartages, by removing the works to a point contiguous to the railway station. The Company at their meeting unanimously resolved to feu a portion of the Wilton Glebe, and upon the ground so acquired it is proposed to begin to erect the necessary new works. Another reason which induced the Company to come to this decision is that their present works are by far too small for the rapidly increasing business.

Within the past few months there have been many changes in the management of gas-works in Scotland, but few of the readers of the JOURNAL will be prepared for the announcement that Mr. Robert Mitchell, lately of Coatbridge, and now of the Dawsholm works belonging to the Glasgow Corporation, has been appointed Engineer and Superintendent of the Edinburgh Gas-Works. When I state that few will be prepared for such an announcement, I mean that his transference from Coatbridge to the neighbourhood of Maryhill was so recent, that further changes, in the meantime at any rate, could hardly be expected. But the duties at Dawsholm, I understand, were not altogether suited to the tastes of Mr. Mitchell, and accordingly, when it was announced that Mr. Barclay Henderson had, after a life of devotion to his duties, retired from the practical superintendence of the works in Edinburgh, Mr. Mitchell made application for the post. The candidates included several gentlemen south of the Tweed; but the Directors, after inquiry, have selected Mr. Mitchell as their Engineer and Superintendent.

The movement for the formation of water supply districts in the rural parishes of Scotland seems to be gathering strength, and to be spreading from one end of the country to the other. At a meeting of the Bathgate Parochial Board, acting as the Local Authority, it was resolved this week to form the village of Bridgend into a special water supply district. The Linlithgow Police Commissioners have been debating the subject of improving the existing water supply of the town. A majority have resolved upon certain improvements which are strongly objected to on the ground that they are but the commencement of an expensive water scheme. At a meeting of the Galashiels Town Council on Monday it was stated that the actual cost of the water-works was £50,000, or £1500 more than the estimate price, and that it would be necessary to borrow £10,000. A statement of the amount expended in connection with these works, and an estimate of the probable sum yet required, are to be prepared, and will be submitted to a special meeting. The Dunfermline Town Council have agreed to grant a supply of water to the North Queensferry supply district. The Aberdeen Town Council have, I believe, resolved to grant a supply of water to the village of Torry, on the opposite side of the river from the city, under certain conditions respecting the roads, &c.

The Kirkcaldy Town Council, or such members of it as are resolved on prosecuting the scheme for bringing a larger supply of water into the town, as well as into the town of Dysart, are likely to have a hot time of it. An active opposition has arisen, the champion of which seems to be a Mr. Westwater. This gentleman, living in the very hotbed of Radicalism, is an Ultra-Radical of the most pronounced type, if one is to judge by his utterances. He characterizes the scheme, which, by the way, is to afford a more plentiful supply of water for the manufactories that abound in the town, as "the foulest tyranny ever inflicted on a free people," and he said he would rather throw away the money which had already been spent than that they should lose their liberties. He would, he said, resort to any meanness to defeat the measure. Despite, or perhaps rather because of this bombastic nonsense, the Commissioners have carried their point so far.

I recently mentioned that the Sheriff Substitute of Perth had ordered the Local Authority to form the village of Stanley into a water supply district. The objectors to the scheme brought this decision under the review of the Sheriff Principal, and he has now decided to remit to Mr. Thomas Stevenson, C.E., to inquire and report as to the tendency of the district to increase or otherwise; the quantity of the present supply and its quality; and whether a sufficient supply can be obtained from present sources.

Great dissatisfaction has prevailed for some time as to the water supply of the village of Bora—a supply which is taken from the river of that name, and which is said to be impregnated with all sorts of filth—and, as the Local Authority refused to move in the matter, the Sheriff was appealed to. He has defined a water supply district, and in doing so condemns in strong language the nature of the pollutions complained of.

(FROM OUR GLASGOW CORRESPONDENT.)

GLASGOW, *Saturday*.

The most prominent fact this week in connection with gas matters, coming within my province, is the resignation by Mr. Mitchell of the appointment which he received about two months ago from the Glasgow Corporation Gas Commissioners, to serve as Manager at the Dawsholm Gas-Works. The reason of his sudden resignation is the fact that he has just been appointed by the Edinburgh Gaslight Company to the position of Engineer and Superintendent of their works, both indoors and out-of-doors—a position which is well-nigh the "top of the tree" in the gas engineering profession in Scotland. Rarely has it fallen to the lot of so young a man to attain such a high position in gas managership; and he is already receiving the hearty congratulations of professional brethren. Mr. Mitchell will not leave Glasgow till about the beginning of February, and in the meantime the Corporation Gas Committee will proceed again to make a new selection for the Dawsholm station. It is not unlikely, I understand, that they will limit their choice to the small leet from which Mr. Mitchell was eventually chosen.

At the last monthly meeting of the Town Council of Rothesay, the Gas Committee reported that they had made the usual inspection of the gas-works, which were found to be in good order. The report also stated that the quantity of gas manufactured during the month of November was 2,330,300 cubic feet, being an increase of 292,200 feet as compared with the corresponding month of last year.

The Police Commissioners of Ayr, at their ordinary meeting held last Monday, had under consideration the securing of suitable premises for carrying on gas-testing operations; and at the same meeting they agreed to take steps to ascertain the price of the necessary apparatus. A report was submitted from Mr. Robb, Manager of the gas-works, stating that the illuminating power of the gas supplied by the Gas Company during the month of November had been 26·2 candles, and that, as usual, it had not on any night fallen below 24 candles. In the course of a conversation which ensued, it was stated that as the Company was a private one the Commissioners could not interfere in regard to the quality of the gas supplied.

A meeting of the principal feuers in the village of Kilmalcolm, a kind of residential suburb for well-to-do people carrying on business in Glasgow, Greenock, Paisley, &c., held another meeting last night, to consider the question of public lighting. Hitherto it has been carried on from a fund raised by voluntary subscription, but as many of the people who were getting the benefit of the lighting did not contribute to the fund, the lighting has not been resumed this winter. From the tenor of the remarks made at the meeting it is very probable that an attempt will be made to form the place into a burgh, under Lindsay's Scotch Police Act of 1862, and so make the assessment for public lighting compulsory, if the ratepayers do not now agree to the imposition of a uniform voluntary lighting rate. There is not any prospect of the Gas Company taking the street lighting in hand, as a large proportion of the Shareholders are non-resident.

The subject of adopting the Burghs Gas Supply (Scotland) Act was under consideration at a meeting of the Town Council of Crieff held last Monday night. Mr. Cochrane said that he had brought up the question about three years ago, but he hoped that it would now be taken up in earnest; and with this view he proposed that a Committee be appointed to communicate with towns similar to Crieff, to get up information on the subject and report to the Council. Some conversation took place on the question raised by Mr. Cochrane, one of the speakers being the Provost, who said he did not know a town worse off for gas than Crieff. He burned paraffin oil, and were others to do likewise they would make the Gas Company do better. Eventually a Committee was formed for the purpose, with Mr. Cochrane as Convener.

The Falkirk Lighting Company have resolved to reduce the price of gas from 4s. 7d. to 4s. per 1000 cubic feet, the reduction to take effect from the last meter survey. It may be remembered that when this Company took over the works, now a little over two years ago, the price of gas was 5s. 10d. per 1000 feet, so that altogether a reduction of 1s. 10d. has been made. From calculations which have just been made it is considered that the gas consumers of Falkirk will be paying, with the present reduced price of gas, fully £2000 less than two years ago.

In last week's "Notes" I referred to the rapid increase in the consumption of gas for cooking and heating purposes in the town of Dumbarton, and now I have to mention that there is also in progress an extension of electric lighting for industrial purposes. A well-known marine engineering firm in that town have for some time had the electric light in use in their engine shop, and at present they are fitting up the necessary arrangements, and getting new dynamo-electric machines placed for the purpose of extending the light into their new and extensive boiler-shed. By-and-by they will doubtless be able to say what amount of economy, if any, has attended the adoption of the electric light in their extensive works.

It is stated that the town of Kelso was one of the first places in Scotland to introduce the system of lighting by gas, and, acting on the belief that it is as well adapted as ever to become a pioneer in progress, there are some people who think it ought to be among the first provincial towns in Scotland to be lighted by electricity. The Police Commissioners are urged to think over the matter seriously, and to open communication at once with Mr. Swan, of Newcastle, with the view of arranging with him to light the streets of the town by his system, which, it is said, makes lighting by electricity much more economical than the methods previously in use. Persons who talk in this way either do not know or ignore the fact that the Burgh Police Commissioners in Scotland have no power to use burgh rates for public lighting in the way suggested, even though it were proved that electric lighting were as economical and efficient as lighting by gas.

During the week the pig iron warrant market has been firmer, and a fair

business has been done at better prices. This firmness arises chiefly through the hopeful anticipations of what the opening year will do. The makers are readily meeting this demand, and iron is being rapidly pushed into store in order to meet it. The closing prices were—buyers, 51s. 6½d. cash, and 51s. 9d. one month, and sellers 1d. more, the gain over the week being 6½d. per ton.

There is an average demand in the coal market, more regard being shown for house descriptions. Prices remain unchanged.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

A quiet tone still prevails throughout the coal trade of this district, with, if anything, a want of firmness in prices, sellers in the large colliery districts of West Lancashire being unable to maintain the full extent of the advance attempted at the commencement of the month. For the better classes of round coal there is only a moderate demand as compared with the pressure for supplies which existed last month, and at many of the collieries there have not been sufficient orders coming in to keep them going all through the week. For best Wigan Arley the average price obtained at the pit's mouth is not more than about 9s. per ton, whilst inferior qualities are offered at from 6s. 6d. to 7s. 6d., and good Pemberton four-feet at 7s. to 7s. 6d. per ton. In common classes of round coal the demand for ironmaking purposes continues only limited, and the really obtainable advance has been very small; good qualities of steam and forge coals being still offered at the pits at from 5s. 3d. to 5s. 6d. per ton, and there is some pushing for orders in the market. In engine classes of fuel trade is tolerably steady. The mills throughout Lancashire are now tolerably well employed, and their requirements for slack are to a considerable extent counterbalancing the increased production of this description of fuel; good qualities at the pit's mouth still fetching from 3s. to 3s. 6d. per ton, and common sorts 2s. 6d. to 3s. per ton. Burgy, which meets with only a limited inquiry, is quoted at about 4s. to 4s. 6d. per ton at the pit.

For local-made cokes there is still a tolerably fair demand for iron-making purposes at about late rates, and I have heard of some very large transactions in north country cokes for next year, which would seem to indicate the anticipation of a considerable amount of activity in this description of fuel.

The iron trade has been only dull, and any business offering is chiefly for delivery over the second quarter of next year. Where sellers are willing to contract up to the end of June at present rates, orders are to be secured; but local makers of pig iron decline to go beyond the end of March, for which period they are firm at 46s. 6d. to 47s. 6d. per ton, less 2½ per cent. for delivery equal to Manchester. Finished iron makers report trade very quiet, and in some cases specifications are only now coming in for iron sold during the period of high prices at the commencement of the year. Founders especially are very dull, and pipes and other descriptions of castings are quoted at very low figures. For bars delivered into the Manchester district the average price remains about £5 15s. per ton.

The agitation for an advance of miners wages outside the Manchester district has so far been unsuccessful, and until there is a more substantial improvement in trade it is scarcely probable colliery proprietors will be willing to pay any higher rate of wages.

THE SOUTH STAFFORDSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The tone of the markets generally in the coal trade of this district remains unchanged. Though there is still considerable room for improvement, masters agree in their expression of a better existing demand. In particular may be noted the pits of the Cannock Chase district, wherein the hands are perhaps doing more regular and longer turns than have been known for a long time past. Here orders are pretty plentiful, both for deep and shallow coals. In other parts of the district fuel for manufacturing purposes is being raised plentifully, and the stocks at the pit's mouth are being rather reduced than otherwise. Gas coals are not so much looked for; rates, however, are firm.

The iron trade is steady, and transactions are fairly numerous both in regard to raw and finished material. The near approach of the quarter's end is causing buyers of large parcels to withhold orders. It is generally considered improbable that any alteration will be made in the existing rates of best makers. List houses, however, are firm, and there are plenty of inquiries for forward delivery. The demand for unbranded bars is sustained, as also it is for sheets and hoop iron. For several classes of manufactured iron there is notably a weaker market, owing in particular to the near approach of the holidays. Smelters are turning out a slightly increased quantity of pig, which fact is also attributable to the nearness of the Christmas holidays. The iron workers have expressed themselves strongly on the subject of the recently regulated sliding scale, and have resolved to terminate forthwith. The Wages Board are now considering what movement will be most advisable in the matter. Sheet iron manufacturers are busy, and orders for export are more numerous. Prices of finished iron at the recent markets were unaltered; best marked bars being firm at £7 10s.; unbranded bars, £6 to £6 10s.; and strip and hoop realizing £6 5s. to £6 10s. Pig iron was slightly a better sale, and inquiries were numerous. Ironstone sold well, as also did other minerals.

YORKSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The iron trade in both the South and West Yorkshire districts has undergone no alteration since last week, either in value or demand. The make of pig iron is fully an average, one of the furnaces being kept in full work. In finished iron neither district presents much alteration. The foundries are by no means well off for orders, except where goods of special note, such as gas and water apparatus, are produced. A very large tonnage of ironstone is being imported from North Lincolnshire, in which district trade continues lively. Most of the works devoted to the production of Bessemer steel rails, axles, &c., are well off for work.

The coal trade, taken as a whole, was, up to the middle of last week, in a moderate state. The mild weather has of late greatly influenced the sales, but with the return of keen frosts the trade is improving. In the Methley part of the West Riding district there has been a falling-off during the week, some of the pits only making four days per week. In the southern part of the coal-field, business up to a few days ago was sluggish, but an improvement seems now to have set in. The London trade during last and most of the present month has been pretty good. Both the Midland and Great Northern, as well as the London and North-Western Railways, have sent a very fair tonnage. The Silkstone and thick-seam pits have forwarded increased supplies. From both South and West Yorkshire a large quantity of steam coal has of late been sent to Hull. Out of 95 collieries which send coal to this port, 24 in Yorkshire last month contributed no less than 81,227 tons, more than half of which went from West Yorkshire. Grimsby is taking fully an average tonnage from South Yorkshire, and Goole from the West Yorkshire pits. The contracts for gas coal, which were entered into earlier in the year, are just now in full operation, so that collieries which are raising a good gas coal are working very well. The largest tonnage from South Yorkshire appears to be going to the Midland Counties. The sale of slack and small coal for manufacturing purposes is not over good, and as the coke trade is slacker, prices are rather lower. The output of coke is pretty well sustained, but at the North Gawber Hall Colliery there are rather formidable stocks on hand.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The gas coal trade of the county of Durham kept very busy over the whole of last week, notwithstanding the detention in the early part of it of steamers in their passage from the south.

The collieries are full of business until the end of the year, and the principal pits in the trade cannot give a loading turn until the first week in January. The shipping trade was very active up the Tyne Dock in the last few days of last week, and the shipments were very little short of those of the previous week. Most best qualities of north country coals have improved in value in December, though where the advance has been made it has been very slight. This improvement has lasted in the sale of manufacturing, small, and coking coals for the local iron and chemical works. Contracts continue to be entered upon for the supply of coke over the next half year in the iron-works, at slightly higher prices. The prospects of the steam coal trade for next year are tolerably satisfactory.

The supply of steam tonnage for coasting purposes increases. A fair number of boats are on offer. Rates to London are 4s. 1½d. per ton, which is 4½d. down. Small sailing vessels are very scarce; in fact, they are not to be had. It is every day becoming more apparent that some other arrangements will have to be made in the future for the conveyance of coal to the bye-ports than by ordinary sailing vessels. The scarcity of little craft of six keels and upwards stands very much in the way of the shipment of small parcels of fire-bricks, pipes, and this class of material.

As is usual within a week of Christmas, there is a pause in the general manufacturing business. Nothing is being transacted for next year. Speculation seems to be quite out of the market. The chemical trade gives some indications of improvement, and soda, bleaching powder, and ash bring somewhat better prices. The fire-brick trade is extremely quiet. There are some inquiries for next year's delivery, but they have not led to any great amount of business so far. There are few transactions in cement, or material of that description, and the finished iron and foundry business is doing best in the larger sorts of work for the iron shipbuilding yards and the marine engine factories. They are very well employed on the Tyne. There is no special demand for timber of any description. A quiet hand-to-mouth trade is being transacted, and no more. The lead trade is flat.

SALES OF GAS AND WATER SHARES.—On Tuesday, the 14th inst., Mr. B. Powell offered for sale at Aylsham eleven £10 shares in the Aylsham Gas Company, which realized prices ranging from £14 to £15.—At Faversham, on Wednesday last, Mr. H. Minter offered for sale by auction the following gas and water shares, which realized the prices stated:—19 fully paid-up £10 shares in the Folkestone Water Company, £19 and £19 5s. per share; 5 fully paid-up original £10 shares in the Faversham Water Company, £17 per share; 5 fully paid-up preference £10 shares in the same Company, £18 per share; and 3 ordinary £10 shares, £5 paid up, in the same Company, £12 5s. per share; 14 fully paid-up £10 shares in the Dover Gas Company, £15, £15 5s., £15 10s., and £15 15s. per share.

RETURN to the Metropolitan Board of Works of the testings made at the gas-testing stations during the week ending Dec. 15, 1880.

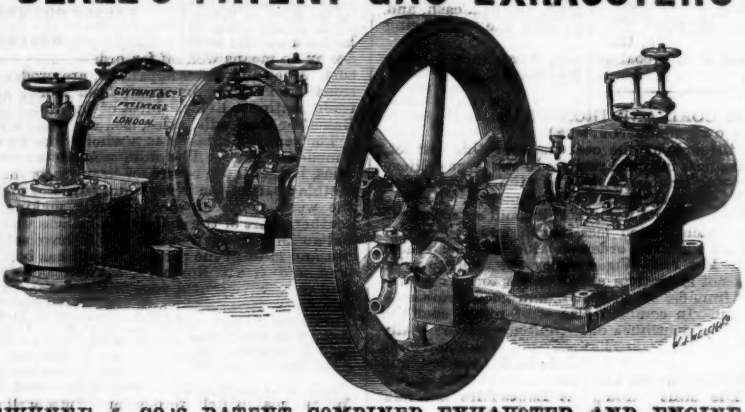
Company.	District.	Illuminating Power. (In Standard Sperm Candles.)			Sulphur. (Grains in 100 Cubic Feet of Gas.)			Ammonia. (Grains in 100 Cubic Feet of Gas.)			Sulphuretted Hydrogen.	Pressure.
		Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.		
The Gaslight and Coke Company	Notting Hill	17·5	17·0	17·3	10·0	8·6	9·4	0·3	0·0	0·1	None.	In excess.
	Camden Town	17·7	16·4	17·2	17·8	14·6	16·5	0·1	0·0	0·0	"	"
	Dalston	17·5	16·6	17·1	15·2	9·5	12·0	0·3	0·0	0·1	"	"
	Bow	17·5	16·7	17·1	14·6	11·9	13·8	0·4	0·2	0·3	"	"
	Chelsea	16·8	16·1	16·6	16·5	13·9	15·0	0·6	0·0	0·2	"	"
	Kingsland Road	17·3	16·7	17·2	14·8	12·1	13·4	0·2	0·1	0·1	"	"
	Westminster (cannel gas)	21·4	20·6	21·0	20·3	15·0	17·1	0·0	0·0	0·0	"	"
South Metropolitan Gas Company	Peckham	16·4	16·4	16·4	11·5	8·9	10·5	0·2	0·0	0·0	"	"
Commercial Gas Company	Old Ford	17·6	17·1	17·3	15·9	12·9	13·9	0·6	0·2	0·3	"	"
	St. George-in-the-East	17·9	17·0	17·6	12·0	10·6	11·0	0·2	0·0	0·0	"	"

(Signed) T. W. KEATES, F.I.C., Consulting Chemist and Superintending Gas Examiner.

Note.—The standard illuminating power for common gas in the Metropolis is 16 sperm candles, and for cannel gas 20 sperm candles. Sulphur not to exceed 20 grains in the 100 cubic feet of gas at Bow station, and 25 grains at all other stations. Ammonia not to exceed 4 grains in the 100 cubic feet of gas. Sulphuretted hydrogen to be entirely absent. Pressure between sunset and midnight to be equal to a column of one inch of water; between midnight and sunset, six-tenths of an inch.

GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.

THE GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION, and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & Co., for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.



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The Judges report on the COMBINED EXHAUSTER and STEAM-ENGINE exhibited at the Philadelphia Exhibition is —*"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship."*

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GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE. Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

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WITH

Wrought-Iron Spindles and

ENGINES COMBINED.

SOLE MAKERS,

GEORGE WALLER & CO.

MAKERS OF ENGINES, EXHAUSTERS, INDEX AND DISC GAS-VALVES, HYDRAULIC MAIN VALVES, BYE-PASS VALVES, TAR, LIQUOR, AND OTHER PUMPS, SCRUBBERS AND PURIFIERS, CONDENSERS, BOILERS, &c.

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

[*SEE ALSO ADVERTISEMENT, PAGE* 990.]

Phœnix Engineering Works:

HOLLAND STREET, SOUTHWARK, S.E.

WANTED, Readers of a Pamphlet, prepared for Gas Companies to distribute to Gas Consumers—"Copking & Heating by Gas;" on Burners, &c.

Copies, by post, Threepence, direct from the Author, MAGNUS OHREN, Assoc.M.I.C.E., Gas-Works, SYDENHAM.

WANTED.—The Advertiser, a Young Man, aged 39, married, is open for an Engagement as MANAGER and SECRETARY of a medium-sized Gas-Works, or SUB-MANAGER of a large Works. Has a thorough Knowledge of the Manufacture and Distribution of Gas in all its branches, having had sole management of Gas-Works for 16 years. Highest testimonials and references.

Address No. 678, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Newcastle-under-Lyme Gas Company, a good, efficient, and steady GAS-FITTER. General good character indispensable.

Applications and references to be sent to the undersigned.

W. WINSTANLEY, Engineer and Manager.

TO GAS MANAGERS.

WANTED immediately, by the Town Commissioners of Newry, a competent MANAGER for their Gas-Works, at a salary of £150 per annum, with residence, coal, and gas.

Applications, with copies of testimonials, to be addressed to the Chairman of the Gas Committee.

JOHN KERNAGHAN, Secretary.

Newry, Dec. 17, 1880.

WANTED, a Second-hand Beale's EXHAUSTER equal to about 10,000 or 12,000 ft. per hour.

Address FREDK. S. HEMPLEMAN, Manure Works, West Ham, LONDON, E.

THE Town Commissioners of Bandon will receive APPLICATIONS from persons competent to discharge the duties of MANAGER and FITTER of their Gas-Works. Salary at the rate of £100 per annum, with residence, coal, and light.

Applications, accompanied with reference and testimonials, to be lodged with me, on or before Saturday, Jan. 1, 1881.

S. R. TRESILLIAN, Clerk to the Commissioners.

Bandon, Dec. 9, 1880.

TO GAS ENGINEERS AND MANAGERS.

WANTED, by the Georgetown (British Guiana) Gas Company, Limited, an ENGINEER and MANAGER for their Gas-Works, at Georgetown, Demerara.

Salary £300 per annum, with a bonus of £50 for every 1 per cent. per annum paid in dividend over 5 per cent. per annum on the ordinary share capital. The Company are at present paying 8 per cent. per annum on the preference, and 7 per cent. per annum on the ordinary shares; £75 per annum will be allowed for house rent; coke and gas free; the Company also provides a horse and carriage; passage out and home paid for, half salary allowed during passage out and home, and full salary on arrival.

An agreement must be entered into for a period of five years, terminable, at the option of the Company, at the expiration of the first or third year. Form of agreement to be seen at the Office.

Security required to the extent of £500.

The selected candidate must be prepared to leave England not later than the 31st of March next, but will not take charge as Manager until July 25 next.

Applications with testimonials (copies only) to be forwarded to the Secretary of the above Company, 30, Gracechurch Street, London, on or before Jan. 31, 1881.

By order,

ALFRED LARS, Secretary.

Offices, 30, Gracechurch Street, London,
Dec. 17, 1880.

GAS-METER MAKING AND REPAIRING.

FOR SALE, as a going concern, capital PLANT, in good working order. In coming about £150.

For particulars address U 334, *Mercury* Office, LEEDS.

GAS PLANT FOR SALE.

THE Buxton Local Board have for Sale One EXHAUSTER, Engine, Bye-pass, &c., complete, with 8-in. Connections, for 10,000 per hour, two 8-in. Braddock's Compensating Governors, with bye-pass to serve for one or both, and one circular-cased Station-Meter, by Newton, of Oldham, 60 ft. per revolution, bye-pass, &c., complete.

For price and particulars apply to Mr. Geo. Smedley, Gas Office, Buxton.

JOSIAH TAYLOR, Clerk to the Board.

AMMONIA PLANT FOR SALE.

A COMPLETE Plant in thorough work-ing order, to make up to 1½ tons daily; or Saturator and Crystallizing Pans will be sold separately. Also Cornish and other Boilers, Tar Stills, Hydraulic Press, Iron Tanks, Tangye's Pumps, &c., for Sale, and Waterside Premises to be Let.

Apply to T. V. CLARKE, on the premises, Trundley Lane, Surrey Canal, DEPTFORD, S.E.

Mr. Clarke will contract for the Re-erection of the Tar and Ammonia Plant in any part of the country.

THE Gravesend and Milton Gas Com-pany have FOR SALE, Four 12 ft. square PURIFIERS, 4 ft. deep, with 12-in. Connections and eighteen 12-in. Donkin's VALVES, together with Lifting Apparatus, all in fair condition, and can be taken possession of immediately; also one 8-in. GOVERNOR, by Sugg, of Westminster.

For further particulars apply to the undersigned.

S. SOWOOD, Manager.

TAR FOR SALE.

THE Directors of the Dronfield Gaslight and Coke Company are prepared to receive TENDERS for the Purchase of the Surplus TAR produced at their Works for One year from Jan. 1, 1881.

Tenders, stating price per ton at the Works, or delivered in casks at Dronfield Railway Station, should be sent to the undersigned not later than the 1st prox.

The Directors do not bind themselves to accept the highest or any tender.

CHRISTOPHER THORPE, Secretary.

Chesterfield, Dec. 1, 1880.

WIDNES GAS-WORKS.

THE Widnes Local Board have a set of Four PURIFIERS to DISPOSE of (two of them 9 ft. square, and two 12 ft. square), with 12 in. Inlet and Outlet Pipes, Wrought Covers, Centre Valve, and Overhead Lifting-Gear.

Particulars and conditions may be obtained from the undersigned.

Tenders, endorsed "Purifiers," to be sent in not later than Jan. 2, 1881.

The Board do not bind themselves to accept the highest or any tender.

HENRY ROBERTS, Engineer.

Gas-Works, Widnes, Dec. 7, 1880.

THE Gloucester Gas Company have the undermentioned APPARATUS for Sale :—

About 150 feet of D-shape Wrought-Iron Hydraulic Main, size 19 in. by 19 in. Also about 38 ft. of D-shaped Wrought-Iron Hydraulic Main, size 20 in. by 20 in. Annular Condenser, consisting of six Vertical Pipes, 24 in. diameter, 19 ft. high, with three 12-in. Slide-Valves and 12-in. Connections.

Exhauster (Jones) to pass about 15,000 feet per hour.

Exhauster (Beales) to pass about 25,000 feet per hour.

Two Vertical Steam-Engines, each about 6-horse power, with Pulleys, and Shafting used for driving the above.

Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and four Galloway Patent Tubes.

4-horse power Horizontal Steam-Engine.

Two Purifiers, 16 ft. by 8 ft., with six 12-in. Slide-Valves and 12-in. Connections.

Gasholder, Double Lift, with Cast-Iron Tank, capacity 37,000 feet.

Gasholder, Double Lift, capacity 100,000 feet.

Gasholder, Double Lift, capacity 240,000 feet.

One 12-in. Governor, by Wright, London, with 12-in. Valves, Bye-Pass, and Connections.

Two 12-in. four-way faced Valves, by Cockey.

For further information, &c., apply to the undersigned.

R. MORLAND, Engineer.

South Metropolitan Gas Company—£18,000 B and £12,000 C Ordinary Consolidated Stock, paying Dividends of 11¼ and 12 per cent. respectively.

MR. G. A. WILKINSON is instructed by the Directors of the South Metropolitan Gas Company to SELL by AUCTION, at the Mart, on Friday, the 7th of January next, at One for Two o'clock, in lots, to suit both small and large buyers, £18,000 B and £12,000 C ORDINARY CONSOLIDATED STOCK in the SOUTH METROPOLITAN GAS COMPANY.

Particulars, when ready, may be had of GEORGE LIVESEY, Esq., Engineer and Secretary to the Company, 589, OLD KENT ROAD; of Messrs. JOHNSONS, UPTON, BUDD, AND ATKEY, Solicitors, 20, AUSTINFRIARS; and of Mr. G. A. WILKINSON, Land Agent and Auctioneer, 7, POULTRY.

CORPORATION OF LANCASTER—GAS AND WATER DEPARTMENT.

TO GASHOLDER MAKERS.

THE Gas and Water Committee are pre- pared to receive TENDERS for the Construction and Erection of a Single-lift GASHOLDER, 130 ft. diameter by 30 ft. 6 in. deep, at their Works, St. George's Quay, Lancaster.

Plans and specifications may be seen or copies obtained at my Office, here, on and after Thursday, the 9th inst.

Sealed tenders, endorsed "Tender for Gasholder," must be sent in, under cover, addressed to T. Swainson, Esq., Town Clerk, Lancaster, not later than Tuesday, the 28th inst.

The Committee do not bind themselves to accept the lowest or any tender.

WM. FLEMING, Manager.

Gas-Works, Lancaster, Dec. 1, 1880.

TO TAR DISTILLERS, CHEMICAL MANUFACTURERS, AND OTHERS.

THE Directors of the Alton Gas and Coke Company invite TENDERS for the annual production of TAR and AMMONIACAL LIQUOR from their Works, for the Twelve months ending Dec. 31, 1881, the same to be put on rail at Alton Station, London and South-Western Railway Company.

The quantity of Liquor is estimated at 10,000 Gallons, and varies in strength from 6° to 9° Twaddel, and the Tar is estimated at 5000 gallons per annum.

Persons tendering are requested to quote prices for 6°, 7°, 8°, and 9° Twaddel Liquor, at per 1000 gallons, and for the Tar at per gallon.

The Directors do not pledge themselves to accept the highest or any tender.

Tenders to be addressed

H. W. ELLIOTT, Secretary.

Gas-Works, Alton, Hants, Dec. 18, 1880.

MR. CORBET WOODALL, C.E.,

Has Removed his Office to

PALACE CHAMBERS, BRIDGE STREET,

WESTMINSTER, S.W.

TO TAR DISTILLERS.

THE Directors of the Huyton and Roby Gas Company are prepared to receive TENDERS for the Purchase of their Surplus TAR and AMMONIACAL LIQUOR for Two or Three years, from Feb. 1, 1881.

Further particulars may be obtained from the undersigned.

Tenders to be sent in on or before Jan. 7, 1881.

FREDK. PRITCHARD, Secretary and Engineer.

This day is published, 8vo, cloth, Vol. 3, 438 pp., 185 illustrations, drawn to scale, £1 4s., completing the work,

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Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

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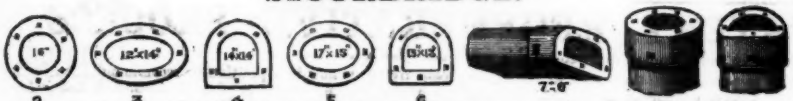

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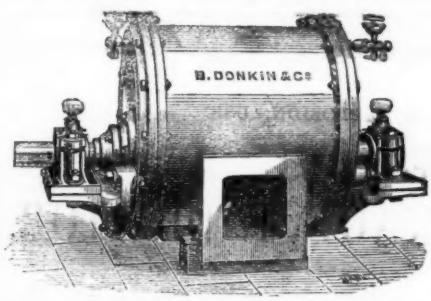
Large Stock of all Sizes of Retorts on Hand.



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MESSRS. B. DONKIN & Co. possess the sole right to manufacture J. Beale's Exhausters under his new patent.

MADE WITH TWO OUTSIDE BEARINGS AND LATEST IMPROVEMENTS.

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We are prepared to treat for the use of the above in large or small quantities with GAS COMPANIES, and to take the same back when spent. Being LARGE CONSUMERS of SPENT OXIDE, we can offer favourable terms for the use of our Oxide.

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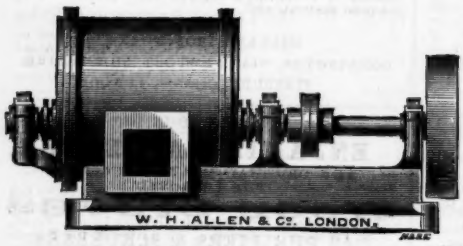
MECHANICAL ENGINEERS, YORK STREET WORKS, LAMBETH, LONDON, S.E.



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These Exhausters are made with the latest improvements, and are further fitted with a new segment of annealed cast iron, so contrived that the gas is not allowed to expand into the Drum, as in the old machine, and a considerable saving is thereby effected.

Combined Direct-Acting Engine and Exhauster, requiring little Foundation.

Makers of GAS EXHAUSTING AND PUMPING MACHINERY.

IMPROVED BEALE'S PATENT.

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THIS CONDENSER, of MOST ECONOMICAL COST, not only EFFECTUALLY COOLS GAS by its LARGE AREA of COOLING SURFACE, but also EXTRACTS ALL TAR, performing both operations WITHOUT APPRECIABLE BACK PRESSURE.

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The Patentee having devoted more time and attention to this subject than perhaps any other person living, is now in a position to recommend the adoption of this process to Gas Companies and Corporations with the utmost confidence in its practical utility, convenience, and economy. 1st. It restores the spent Lime at from one-third to one-half its original cost, apart from its undoubted convenience and the economy of space. 2nd. There is practically no limit to the duration of the Lime. 3rd. The cost of apparatus for the introduction of the process is very moderate and exceedingly durable. 4. The Patentee supplies special bricks and castings, erects and proves the process on the most favourable terms.

The process, in operation, may be seen at the Corporation Gas-Works, Paisley, where the Lime has been restored 120 times. Inspection is cordially invited.

For Terms, apply to GEO. R. HISLOP, F.C.S., Engineer, Gas-Works, PAISLEY, N.B.

R. Macpherson and Co., 9, Coal Exchange, London, E.C.

PRICE £3 15s. EACH.

Important to Gas Companies, Gas Engineers, and Consumers.

TO AVOID RISK OF EXPLOSION, USE

ANSELL'S
PATENT GAS-LEAKAGE INDICATOR.

This marvellous little Instrument, which has been perfected after many years labour, is a wonder of scientific skill, and supplies a want long felt. It instantly shows the presence of gas. Analyzes and gives the percentage of any mixture of gas and air from 1 to 35 per cent. Distinguishes between Coal Gas and Carbonic Acid Gas. Tells an explosive mixture to a half per cent. Detects escapes of gas from fractured or decayed mains, or service-pipes, without the necessity of opening but one-fourth the ground usually requisite. Is a perfect substitute for a light in searching for a leakage of gas. Renders the risk of explosions unnecessary. Is invaluable to Gas Managers, Engineers, Contractors, and Fitters. Is acknowledged by the leading Gas Engineers to be the most useful and perfect instrument of its kind ever invented.

The Instruments, as Indicators, do all but speak, and have only to be looked at to be understood.

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FOR THE ERECTION AND REBUILDING OF GAS AND WATER WORKS,

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TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

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GAS OR OIL
HEATING AND LIGHTING
STOVES.

Silver Medals awarded at Wolverhampton Exhibition, 1878; and Brussels International Exhibition, 1880.

No Injury to Pictures or Plants.
No Flue.
No Danger from Fire.
No Offensive Smell.
Light and Warmth combined.
Cost less than other Fuel.

Messrs. Ritchie & Co. are prepared to supply these Stoves on the best possible terms to Gas Companies to let out to their Consumers on the hire system.

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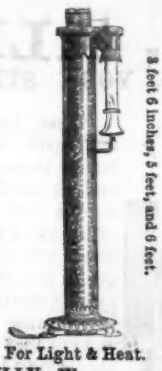

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WOOD SIEVES FOR PURIFIERS,

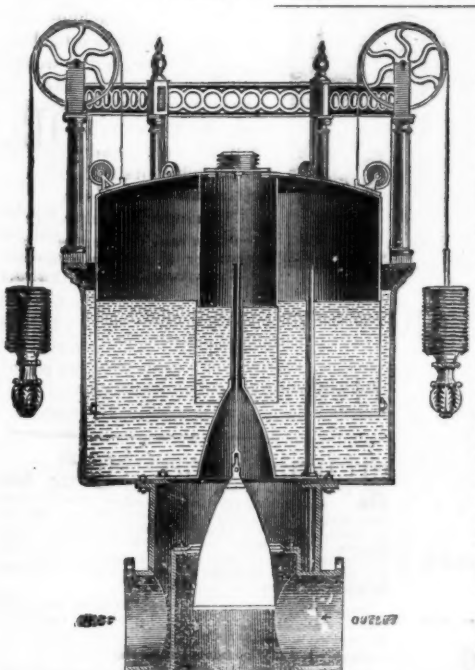
WITH TAPER OR PARALLEL BARS,
MADE BY SPECIAL MACHINERY.
SCRUBBERS FILLED WITH BOARDS,
On our approved principle, for the extraction of Ammonia.
Prices on application. References to First-Class Engineers.
ROSE MOUNT IRON-WORKS,
ELLAND, Near HALIFAX.
London Offices: 2, SUFFOLK LANE, CANNON STREET, E.C.

J. & J. BRADDOCK,
GLOBE METER-WORKS, OLDHAM,
MANUFACTURERS OF
WET AND DRY CONSUMERS GAS-METERS,
OF THE HIGHEST EXCELLENCE ONLY;
ROUND STATION-METERS,
ON CAST-IRON STANDS;
SQUARE STATION-METERS,
WITH PLANED JOINTS.

Messrs. Braddock beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 30-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

C. & W. WALKER'S
WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,
DONNINGTON, Near NEWPORT, SHROPSHIRE.
FINSBURY CIRCUS, LONDON.

ESTABLISHED IN 1860.
ENJAMIN CARPENTER,
THE ORIGINAL MANUFACTURER OF THE IMPROVED
WOOD SIEVES
FOR
GAS PURIFIERS & SCRUBBERS.

PROVIDENCE WORKS,
22, HERMES STREET, PENTONVILLE ROAD,
LONDON, N.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE
FIRE CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.
Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.
Shipments Promptly and Carefully Executed.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
WENLOCK IRON WHARF, 21 & 22, WHARF ROAD,
CITY ROAD, LONDON, N.,

Manufacture and keep in stock at their works (also a large stock in London) PIPES and CONNECTIONS 1½ to 48 inches in diameter; and make to order Retorts, Purifiers, and Tanks, with or without planed joints, Columns, Girders, Special Castings, required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

Note.—Syphons and Covers are joint-faced if required, doing away with millboard and iron boring, or Syphons made without Covers, a socket being cast on and fitted with a small plug about 6 inches in diameter with lead joint. In either way preventing leakage.

GEORGE'S
Patent Gas Calorigen,
A STOVE FOR
WARMING AND VENTILATING.
Recommended by Dr. Richardson.

Manufacturers:
J. F. FARWIG & CO.,
36, QUEEN STREET, CANNON ST., LONDON.

JAMES NEWTON & SONS,
(Established 1820,)
FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
FALCON DOCK, 78 and 79, BANKSIDE,
SOUTHWARK, LONDON, S.E.,
Depôt for STOURBRIDGE and NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for
GAS AND WATER WORKS.

Gold Medal Awarded, Paris Exhibition, 1878.

THOMAS TURTON AND SONS,
SHEAF AND SPRING WORKS,
SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS,
STEEL OF ALL DESCRIPTIONS,
SCREW STOCKS, TAPS, AND DIES, SPANNERS,
RATCHET BRACES, LIFTING-JACKS,
ANVILS, VICES,
AND ENGINEERS TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

BAILEY'S HOT-AIR ENGINE.

(LEHMANN'S PATENT.)

The Best Engine in the Market for Small Industries, Farm Work, Pumping, Hoisting, Printing, &c.

BAILEY'S HOT-AIR ENGINE

WAS

EXHIBITED AT WORK

AT

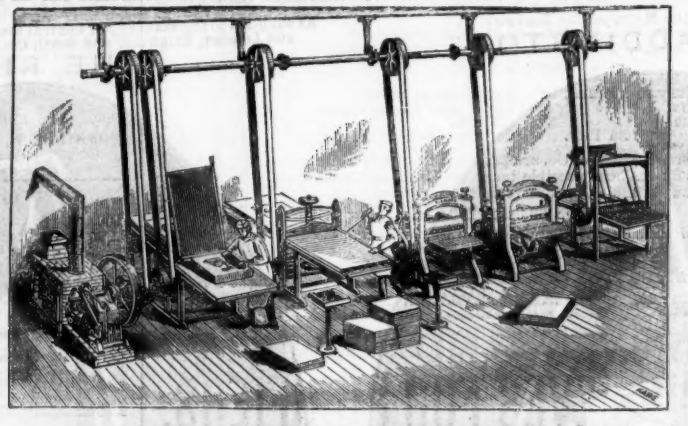
The Royal Manchester and Liverpool Agricultural Show, 1879,

AND WAS AWARDED THE

First-Class

SILVER MEDAL

of the Society.



W. H. BAILEY & CO.

ALSO

RECEIVED A

SPECIAL PRIZE

OF A

SILVER CUP

FOR

THE BEST COLLECTION OF MACHINERY,

of excellent finish, on the ground,

ESPECIALLY

STEAM

FITTINGS.

VIEW AS USED FOR DRIVING PRINTING MACHINERY.

PRINTING OFFICES TURNED AND WARMED FOR 3d. A DAY BY BAILEY'S HOT-AIR ENGINE.

From W. H. Carman, 28, Market Street, Ashby-de-la-Zouch. "To W. H. Bailey & Co., Albion Works, Salford, Manchester, *Nov.* 20, 1880.

"Gentlemen,—The Hot-Air Engine you supplied me with is, I think, the only one at present in the Midlands, and it requires only to be made known to increase its sale. The more I work it the greater amount of satisfaction it gives; and, AS TO ITS COST IN FUEL, IT SAVES ME ABOUT 50 PER CENT., as compared with the ordinary stove formerly used for warming my printing office. I burn a little slack with the coke, and it costs me ONLY THREEPENCE A DAY, from 7 a.m. to 7 p.m.

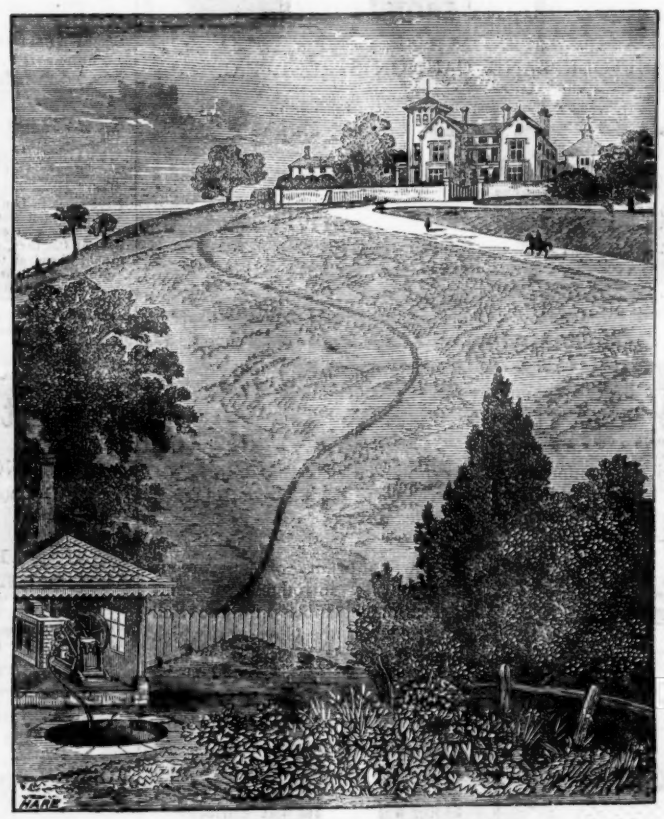
"It is a boon to all who require power for machinery, and I do not hesitate to say that it is the best and cheapest in the market. For any one requiring further information, refer them to me. Yours faithfully, "W. H. CARMAN."

BAILEY'S HOT-AIR ENGINE IS UNRIVALLED AS A PUMPING-ENGINE.

No boiler, no explosions, no danger or nuisance of any kind, consumes its own smoke, no smell from burning oils, works without the slightest noise or vibration. Proved to be cheaper than steam power. It requires less attention than any other Engine; works for years without interruption or repairs.

Patronized by the German, Austrian, and Italian Governments, many Railway Companies, Corporations, Water-Works, Public and Private Institutions, Hospitals, Baths, Hotels, for Gentlemen's Estates, Farmers, Brewers, Tanners, Printers, Butchers, Grocers, Stone Quarries, Mines, &c.

ANY SORT OF FUEL MAY BE USED.



RAISING WATER FOR A MANSION.

A quarry owner writes to say:—"The Hot-Air Engine costs not one-fifth in fuel and wages that the steam-engine it replaced used to cost."

It may be managed by any one, requires next to no attention, and costs for fuel and oil only a few pence per day.

"Top of North Parade,
"Halifax, *Oct.* 12, 1880.

"The Hot-Air Engine I purchased from you a few months ago, I may say, gives full satisfaction. We use the Engine for driving two high-speed Printing Machines, which work it does noiselessly and as uniformly as any motor I have seen. It costs very little in fue, (coke being principally used)l and, better still, takes little or no attention, the person working the Machine not having to stop and attend to it as a Steam-Engine would require; it works two or three hours without requiring any fuel or firing-up. I can well recommend it for small industries as the cheapest motor out.—Yours,

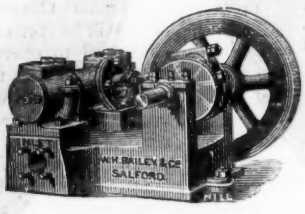
"GEORGE GREENWOOD."

Gas Coke is recommended whenever it can be obtained, although any fuel may be used.

BAILEY'S WATER MOTORS.

Hydraulic Lifts.

Hydraulic Brass-Work.



WATER-MOTOR

Hydraulic Gauges,

Mercurial and Spring.

See Lists. **See Lists.**

(HAAG'S PATENT).

The *Brighton Guardian* is regularly printed by these Motors, giving the highest satisfaction. The One-Horse drives a Double-Royal Wharfedale Machine at Plymouth.

½-Horse, £10. 1-Horse, £12 10s. 2-Horse, £15. 4-Horse, £25. Up to 30 H. P.

For Prices and further Particulars apply to

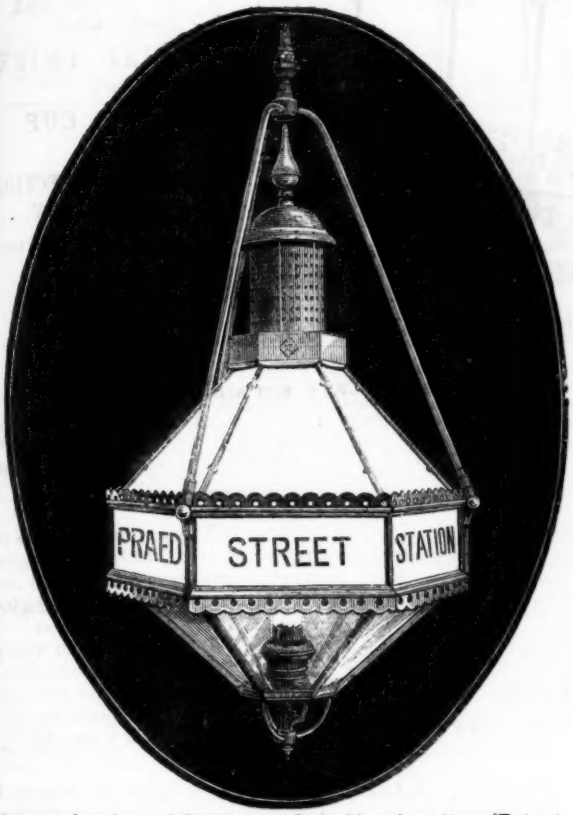
W. H. BAILEY & CO., Engineers, Salford, Manchester

THE ONLY SHADOWLESS REFLECTING LANTERN

For WILLIAM SUGG'S Patent Argand and Flat-Flame Burners of High Illuminating Power, suitable for the Lighting of Market Halls Railway Stations, Hotel Entrances, Shop Fronts, &c.

As supplied to the Metropolitan Railway.

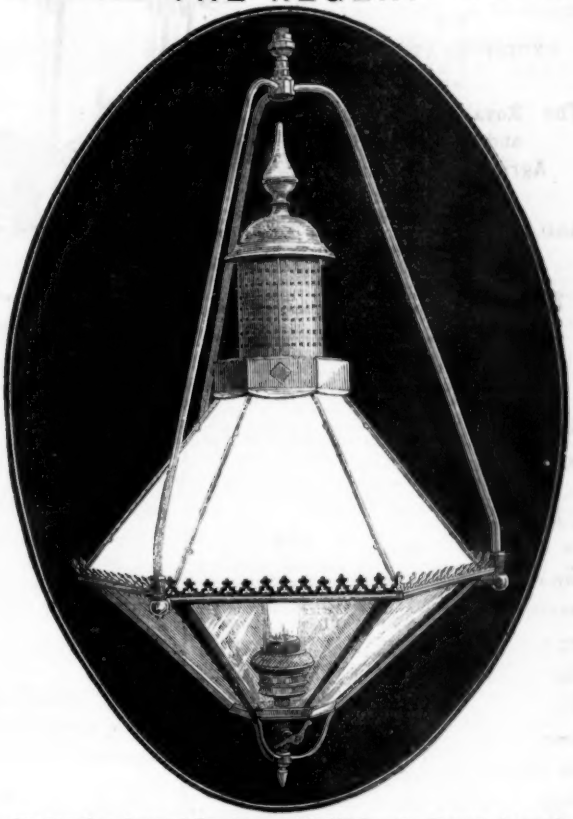
"THE PADDINGTON"



Suspension Argand Lantern made in Sizes to suit my Patent Argand Burner of 50 to 400 Candle Power.

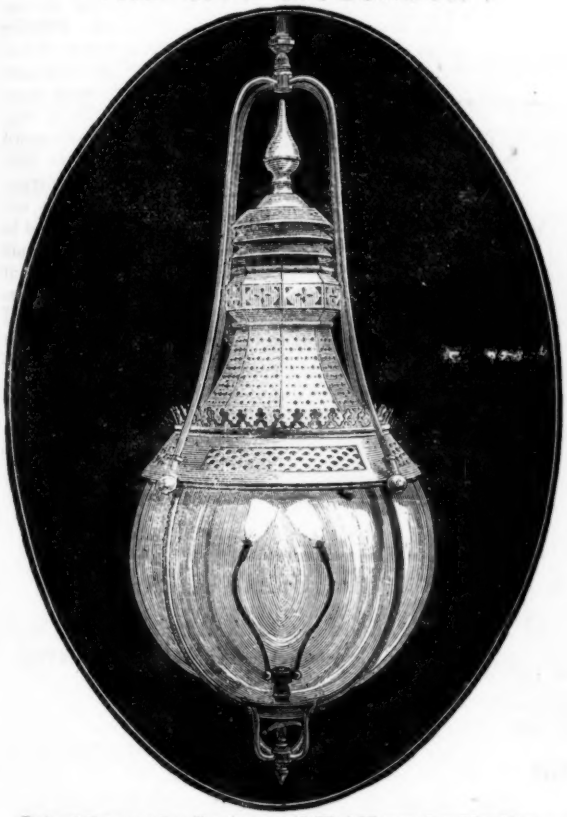
As supplied to the Manchester Central Station of the Cheshire Lines Company, and London, Brighton, and South Coast and Great Northern Railways

"THE REGENT"



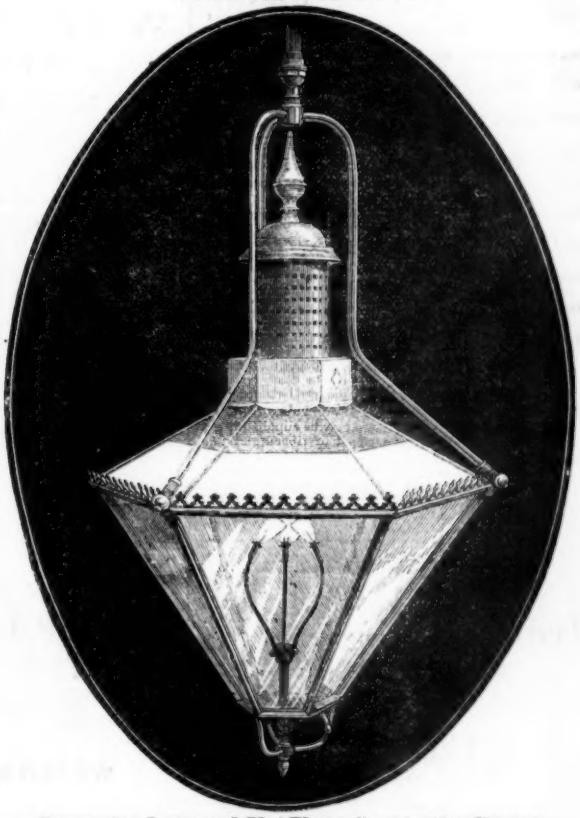
Suspension Argand Lantern, with 100-Candle Patent Argand Governor Burner.

"THE CITY OF LONDON"



Patent Suspension Lantern and Flat-Flame Combination Burner of 50 and 100 Candle Power.

"THE LAMBETH"



Suspension Lamp and Flat-Flame Combination Burner of 50 and 100 Candle Power.

The highest result in Illuminating Power, per cubic foot, was obtained by my Argand and Flat-Flame Burners at the recent trial of Large Gas Apparatus at Birmingham. (See JOURNAL OF GAS LIGHTING, March 16.)—For price and particulars apply to

W. SUGG, Engineer, Grand Hotel Buildings, Charing Cross; and Vincent Works, Vincent Street, Westminster.

T. NEWBIGGING,
CONSULTING GAS ENGINEER,
5, NORFOLK STREET, MANCHESTER.

HENRY LYON,
MECHANICAL AND CONSULTING GAS ENGINEER,
NORWOOD, NORTHENDEN ROAD,
SALE, NEAR MANCHESTER.

ALFRED LASS,
Fellow of the Institute of Chartered Accountants,
SPECIAL ACCOUNTANT FOR GAS AND WATER UNDERTAKINGS,
30, GRACECHURCH STREET, LONDON.

Accounts Analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by Mr. Lass to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, Corporations, and Local Boards.

JOHN ROMANS, C.E., F.G.S.E.,
CONSULTING GAS ENGINEER
AND
CANNEL COAL FACTOR,
30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.
GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

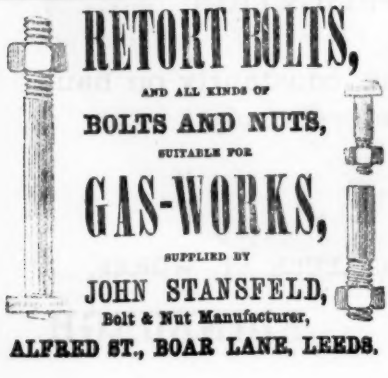
ANALYSIS AND PRICES FORWARDED ON APPLICATION.

THOMAS PROUD,
BROOKFIELD WORKS,
103, ICKNIELD ST., BIRMINGHAM,
MANUFACTURER AND ERECTOR OF
PLANT FOR SULPHATE OF AMMONIA,
ALSO MANUFACTURER OF
WOOD GRIDS
FOR
PURIFIERS AND SCRUBBERS.

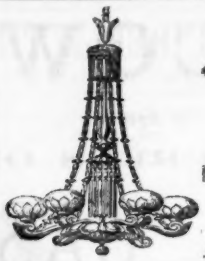
BOX'S PATENT STREET GAS-LAMP

Has the following good qualities:—
1. No putty or other material is required for glazing. Thus there is no hacking out of old putty on removal of the glass, with the *consequent damage* to the lamp frames. 2. No liability to breakage by unequal expansion of the glass caused by changes of temperature. 3. Any inexperienced workman can glaze the lamp in a few minutes. 4. The system of glazing can be applied to any existing lamp at a trifling cost. 5. It is cheap, strong, and durable. 6. The glass can be easily removed so that the frames can be thoroughly painted inside and out.

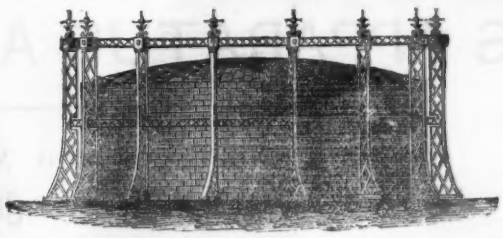
The lamp may be supplied fitted with clear opal or ribbed glass, *as also with enamel tops* if required. The necessary fittings for altering existing lamps to this system can be supplied at moderate prices and a small charge for royalty. Licences granted on the most reasonable terms. For further particulars apply to the Patentee, W. W. Box, Gas-Works, Crayford Kent.



RETORT BOLTS,
AND ALL KINDS OF
BOLTS AND NUTS,
SUITABLE FOR
GAS-WORKS,
SUPPLIED BY
JOHN STANSFELD,
Bolt & Nut Manufacturer,
ALFRED ST., BOAR LANE, LEEDS.

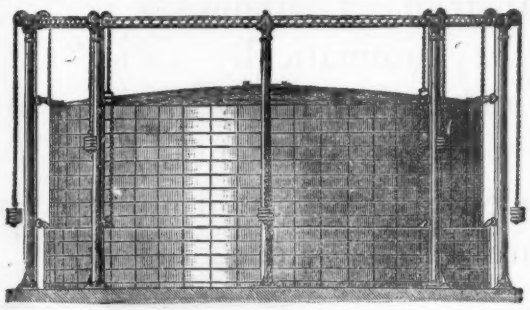


F. & C. OSLER,
45, OXFORD STREET, LONDON, W.
MANUFACTORY AND SHOW-ROOMS:
BROAD STREET, BIRMINGHAM.
ESTABLISHED 1807.
MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,
WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.
TABLE GLASS OF ALL KINDS.
CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.



THE HORSELEY COMPANY,
LIMITED,
TIPTON, STAFFORDSHIRE.
LONDON OFFICE:
6, WESTMINSTER CHAMBERS, VICTORIA STREET,
GAS ENGINEERS, IRONFOUNDERS, &c.,
MANUFACTURERS OF
GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,
AND ALL REQUISITES FOR EITHER
GAS OR WATER WORKS;
ALSO
MAKERS OF ROOFS, BRIDGES, &c.

GEORGE ORME & CO.,
ATLAS METER-WORKS, OLDHAM,
MANUFACTURERS OF
WET AND DRY GAS-METERS,
STATION-METERS, GOVERNORS,
PRESSURE AND EXHAUST REGISTERS,
LAMP-METERS IN CAST-IRON BOXES,
And every Description of Gas Apparatus.



J. T. B. PORTER & CO.,
GAS ENGINEERS & MANUFACTURERS,
IRONFOUNDERS AND CONTRACTORS,
GOWTS BRIDGE WORKS,
LINCOLN.

LONDON OFFICES: 1, WESTMINSTER CHAMBERS, S.W.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.
REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—All Communications to be addressed to the FIRM ONLY.

W. & B. COWAN,

(ESTABLISHED 1827,)

MANUFACTURERS OF

WET AND DRY GAS-METERS,

GAS APPARATUS AND FITTINGS.

Original Licensees and Manufacturers of

WARNER & COWAN'S

PATENT SELF-REGULATING GAS-METER.

STREET-LAMP METERS (with Warner & Cowan's Drums), specially adapted for placing under Roadway, or in Lamp-Pillars.

STREET-LAMP PILLARS, with Pedestals to contain Meters.

GOVERNORS, PRESSURE-REGISTERS, STATION-METERS, TEST-GASHOLDERS, HOURLY RATE AND TESTING METERS, GAUGES, &c.

Manufacturers of

THE AUTOMATIC PRESSURE CHANGER.

(WM. COWAN'S PATENT.)

This Instrument supplies a real want in the most satisfactory manner. It automatically varies the weight or load upon the governor, and consequently the pressure in the main. No personal attention is required, except during a few minutes once a week to wind the clock and weighted pulleys, and, if necessary, to re-arrange the pressures for the succeeding week.

PRICES AND FULL PARTICULARS ON APPLICATION.

Foreign and Colonial Orders provided for by keeping constantly on hand a very large stock of both Wet and Dry Meters, ready for immediate despatch.

CHURCH STREET,
MILLBANK STREET,
(Near the Houses of Parliament,)
LONDON, S.W.

DUTTON STREET,
NEW BRIDGE STREET,
(Near Victoria Station,)
MANCHESTER.

BUCCLEUCH ST. WORKS,
EDINBURGH.

THE MANN & WALKERS' PATENT SCRUBBER.

Extensive use.

The successful and extensive use of the Mann and Walkers' Patent Scrubbers in all parts of the world has demonstrated their advantages, and entitled them to be received with credit and confidence. The number of them in use is about twenty times that of any other known means of purifying gas from ammonia.

Small quantity of Water required.

By a very small quantity of clean water (not more than 5 or 6 gallons per ton of coals carbonized) the whole of the Ammonia contained in the Gas is completely absorbed; the Gas, after only once passing through, issuing from the Scrubber outlet completely purified from Ammonia. The Scrubber gives no appreciable back pressure.

Residual Product obtained.

The Residual Product—namely, the Ammoniacal Liquor—is obtained at from 20 to 30 ounces commercial strength, which enables it, after being mixed with the weaker Liquor from the hydraulic main and condensers, to be sold to the Manufacturing Chemists, or converted into Sulphate, at the degree of strength found most profitable to the Gas Company.

Illuminating power increased.

The Scrubber is a Saturator, and the Gas being soaked in this strong solution of Ammonia in the lower columns of the Scrubber, is purified from a large amount of Carbonic Acid, and its Illuminating Power is thereby increased.

Small amount of power required.

The friction is so little, and the motion so slow, that the power necessary to work the Scrubber is almost inappreciable. A small gas-engine will work a pair of Scrubbers, purifying 2 million cubic feet of gas per day.

Beckton Gas-Works.

There are thirty of these Patent Scrubbers in the Beckton Gas-Works, equal to purifying 30 million cubic feet per day, and the total amount of engine power necessary to work the whole 30 is not equal to that given out by one 10-horse engine.

Reserve purifying power contained.

There is also a most important advantage arising from the height of these Scrubbers, in the reserve force contained in them. In the event of any stoppage, the mass of soaked and wetted material would continue the purification for hours, even if the supply of water and working were stopped from any cause.

Internal Materials not changed.

The changing of the soaking materials in these Scrubbers is very seldom required; they are well known to remain in action for seven years without being emptied.

Guarantee

They are in all cases erected under guarantees; they easily fulfil the stipulations of any Act of Parliament, and the chemical restrictions of the Board of Trade; and in cost they are much less to a Gas Company than any other known means of purifying Gas from Ammonia.

C. & W. WALKER.

8, *Finsbury Circus, London, E.C.*

BRAY'S PATENT LANTERNS

AND

FLAT-FLAME BURNERS,

FROM 40 to 400 CANDLES POWER,

FOR

Lighting Open Spaces, Public Buildings, Railway Stations, Shop Fronts, Hotels, &c.

The understated declaration, with which we introduced our apparatus when the Argand system was in the full tide of its fame, has been fully borne out by general experience, namely—

"THE FLAT-FLAME IS THE ONLY PRACTICABLE SYSTEM FOR STREET LIGHTING; and, 'in actual use,' yields as much light with Common Gas, and more with Cannel Gas, than any Argand System."

BIRMINGHAM LAMP TESTS.

After a series of experiments, extending over more than twelve months, WITH THE MOST EXTENSIVE ASSORTMENT OF BURNERS AND LANTERNS of large lighting power ever brought together, THE BIRMINGHAM AUTHORITIES

ADOPTED BRAY'S SYSTEM

for their street-lighting improvements, for which purpose SIXTY-FIVE 100-CANDLE POWER LANTERNS of medium lighting power have been fixed, SINCE WHICH WE HAVE RECEIVED ORDERS FOR **26** MORE.

The tests showed that our 80-candle **highest** lighting power burner yielded 3·51 candles per foot of gas, which was a higher result than that yielded by any other flat-flame burner (though there were copies of our enlarged and improved Slit-union Burners sent by another party), and higher than the 80-candle power Argands.

IN THE BRITISH ASSOCIATION OF SCIENCE TESTS, 1878,

The highest results obtained by the Burners of the parties here named were:—

	Candles per Five Cub. Ft. of Gas.	Price. s.	d.
Bray's Flat-flame	28·60 ..	0	2
Sugg's do.	25·56 ..	5	6
Sugg's Double-ring Argand .	23·33 ..	18	0

(*See Journal of the Society of Arts, Feb.* 7, 1879.)

The report delivered this year repeats the above UNPARALLELED TESTIMONIAL, by again placing us at the head of all flat-flame burner makers, although copies of our enlarged and improved Slit-union Burners were sent, under another name, by another party.

Note.—It will assist people's judgment if we state that the Argand system has been removed from Waterloo Place, Queen Victoria Street, Billingsgate Market, and other places in London; Sackville Street, Dublin; and Market Place, Nottingham; and that scarcely a week passes but we have applications for Burners and Lanterns TO DISPLACE THE ARGAND APPARATUS.

THE NORTH BRITISH RAILWAY (QUEEN ST.) STATION, GLASGOW, is now being lighted with 30 of BRAY'S PATENT LANTERNS.

THE NEW CALEDONIAN RAILWAY STATION, CARLISLE, is to be lighted with 107 of BRAY'S PATENT 80-CANDLE POWER GLOBULAR LANTERNS.

BRAY'S SYSTEM OF STREET LIGHTING has been adopted by the CORPORATIONS, VESTRIES, and GAS COMPANIES of nearly ALL THE LARGE CITIES AND TOWNS IN THE UNITED KINGDOM.

PRICES AND PARTICULARS ON APPLICATION TO

GEORGE BRAY & CO., LEEDS.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

198, ST. VINCENT STREET, GLASGOW.

TREES BOGHEAD.

SHOTTS BOGHEAD,

And all the first-class Scotch Cannels.

Prices and Analyses on application.

HEBBURN MAIN GAS COAL.

This Coal is now highly approved of for gas making, and yields over 10,000 feet per ton of 15-candle gas, and about 14 cwt. coke.

For references and prices, either f. o. b. or by rail, apply to

W. RICHARDSON,

29, QUAYSIDE, NEWCASTLE-ON-TYNE.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

GAS COAL.

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The HUCKNALL COLLIERY COMPANY can offer a Cannel producing a considerable quantity of Gas of good quality.

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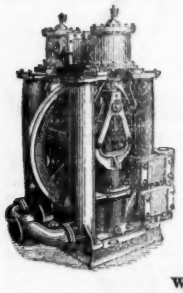

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Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.

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RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

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GAS AND HYDRAULIC ENGINEERS,

Patent Compensating Steam Governor,

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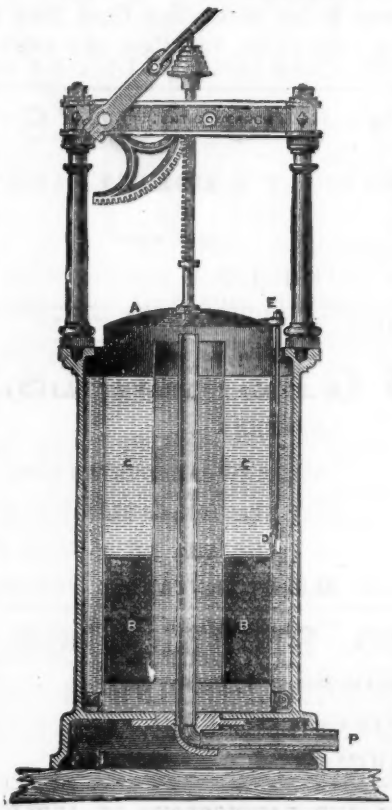

This is the most efficient and perfect Governor yet made to control and regulate the speed of Engines and Exhausters according to the varying make of gas, and maintain a steady gauge, whether working level or with six inches of seal.

It is the only Governor that will effectually control Condensing and Compound Engines, especially when the Exhauster is on light work, and the Engine is large.

During the drawing and charging of Retorts, the Engine requires no attention—a matter of great importance in small works.

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G. W. and Co. make **special Steam Throttle Valves,** suitable for working with this Governor, and alter existing Throttle Valves to same plan.

See also advertisement, page 980.

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OXIDE OF IRON

FOR THE

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SUPPLIED DIRECT FROM THE

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THIS OXIDE IS GOOD IN QUALITY AND LOW IN PRICE.

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The Aldwarke Main Brights is a first-class gas-making and coking Coal, yielding by analysis 12,600 feet of 19-candle gas per ton, and giving "Weight of illuminating matter in lbs. of sperm, 820·80." It is very free from impurities and foreign matter.

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N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

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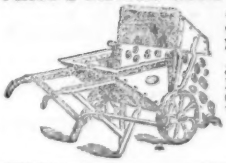

effecting a great saving of time, labour, and expense.

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Prices are Reduced.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

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MESSRS. JOHN ABBOT & CO., LIMITED,

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Manufacture and Erect

SULPHATE PLANT

On the most Modern and Improved Plan.

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Can now be seen at

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And will shortly be erected at the New Gas-Works,

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NEW PATENT WET GAS-METER,
THE "RELIANCE,"

MANUFACTURED BY THE

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SOLE AGENT FOR SCOTLAND: JAMES KEITH, EDINBURGH AND ARBROATH.

The object attained by this invention is the *correct measurement of Gas under every fluctuation of the pressure.*

Accuracy is obtained by subjecting the whole of the water which determines the measuring chambers of the drum to one uniform even pressure, and so prevents unequal displacements of the water-line.

The "RELIANCE" METER has been tested by several of the most experienced official meter inspectors. Copies of their reports may be obtained on application to the

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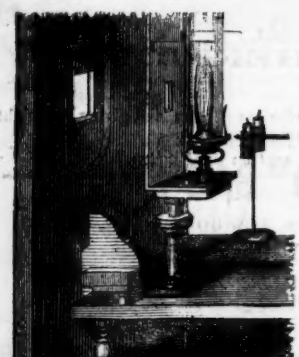

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